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ADOLPH LEUE,
SECRETARY OHIO STATE FORESTY BUREAU,

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For 15363



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FROM

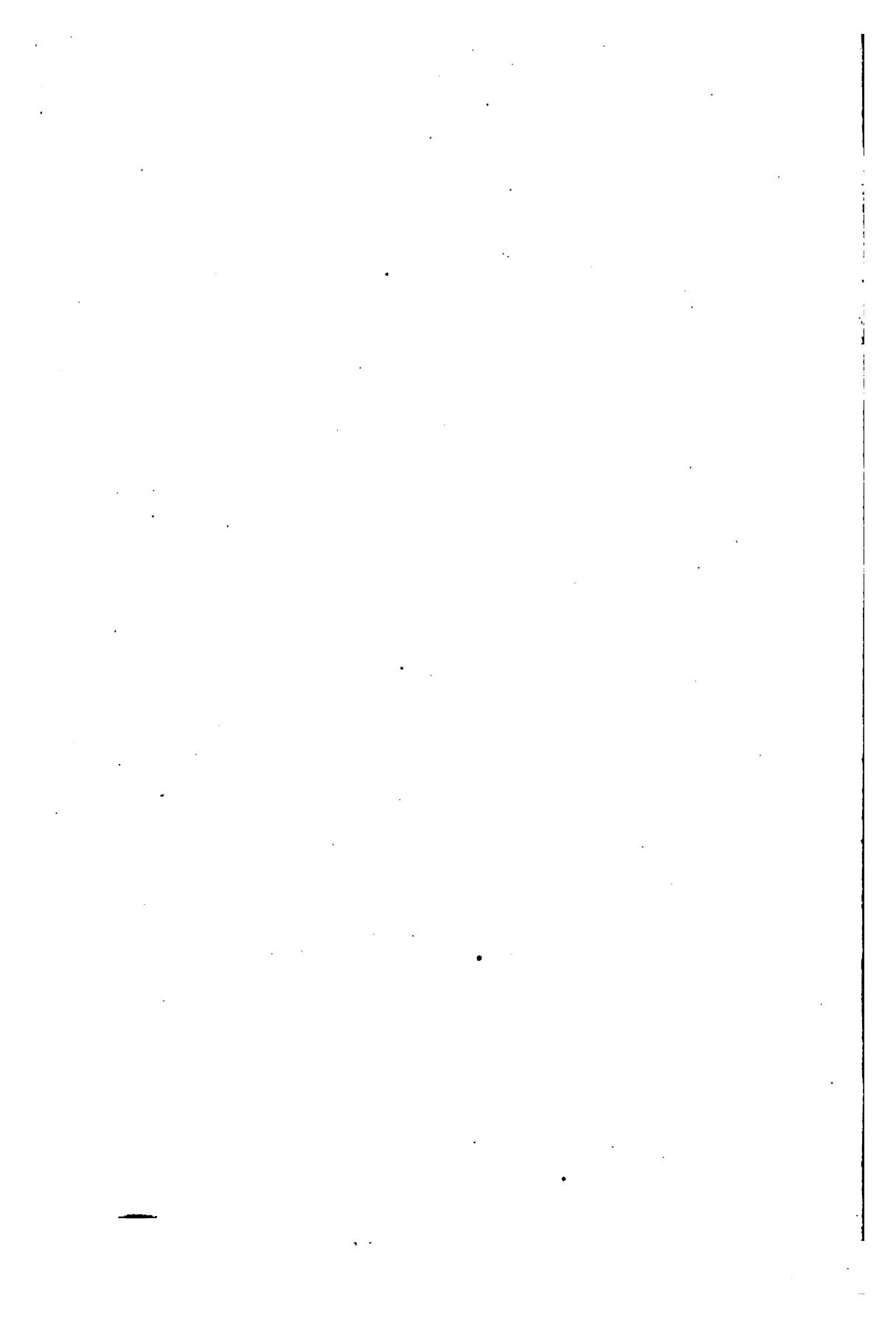
The President's Office.

28 Feb., 1891.

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FIFTH ANNUAL REPORT

OF THE

Ohio-State Forestry Bureau,

TO THE

GOVERNOR OF THE STATE OF OHIO,

FOR THE YEAR 1889.

BY ADOLPH LEUÉ, A. M., PH. D., *Secretary.*

COLUMBUS, O.:
THE WESTBROOK COMPANY, STATE PRINTERS

1890.

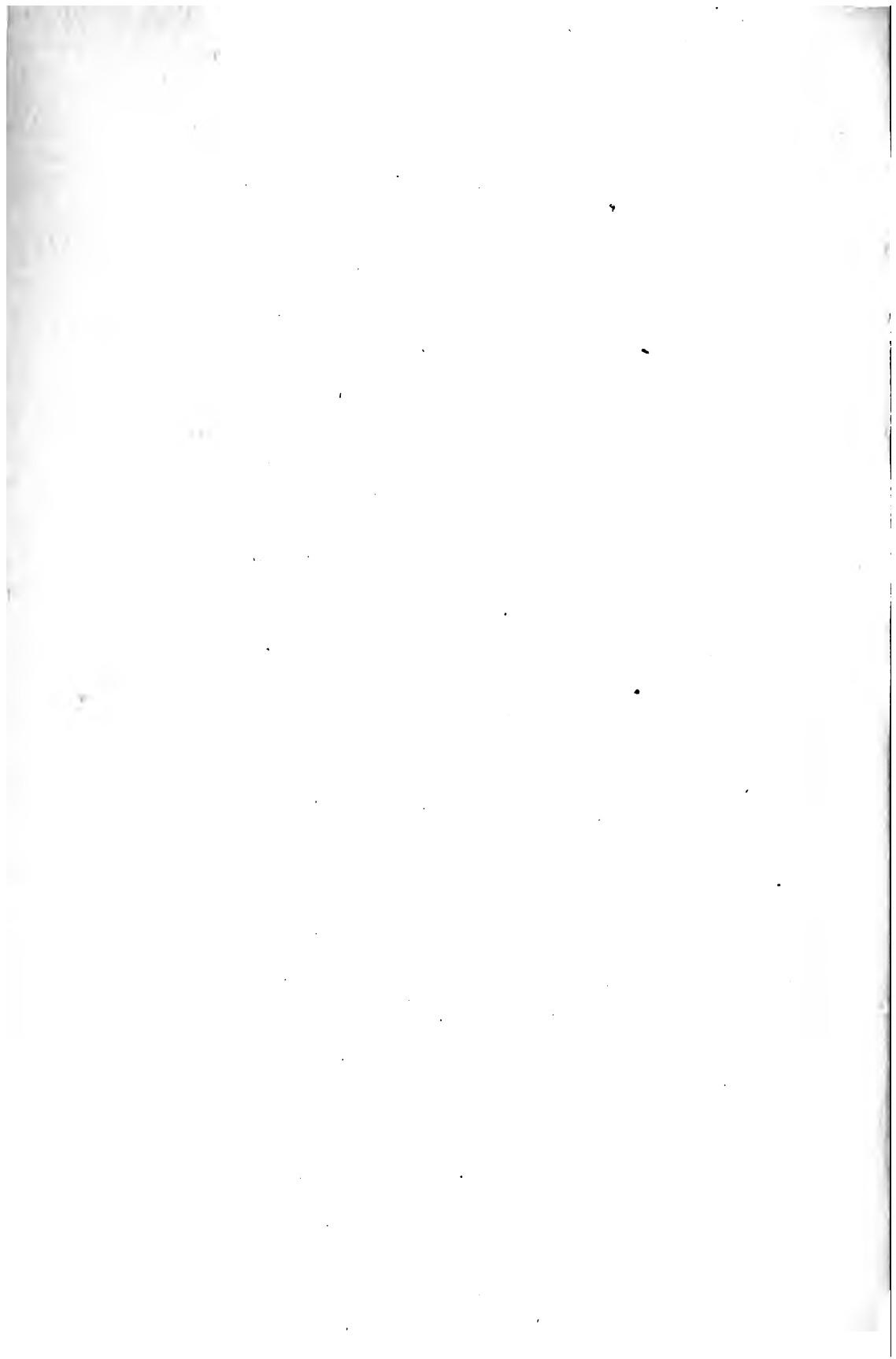
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~~F. 362~~

28 Feb. 1891 -
From
The Resident's Office.

BOARD OF DIRECTORS.

(ORGANIZATION FOR 1890.)

JOHN B. PEASLEE, <i>President</i>	Cincinnati.
JAMES POINDEXTER.....	Columbus.
LEO WELTZ.....	Wilmington.
ADOLPH LEUE, <i>Secretary</i>	Cincinnati.



ANNUAL REPORT.

COLUMBUS, OHIO, June 25, 1890.

To His Excellency, JAMES E. CAMPBELL, Governor of Ohio:

SIR: The act establishing the Ohio State Bureau of Forestry, makes it the duty of said Bureau "to report annually to the Governor the results of the investigations, together with such other information as the Board may deem necessary for the promotion of forestry in the State." In accordance with this provision the Fifth Annual Report is herewith submitted.

As the investigations and proceedings of the Bureau are fully and ably reported by the Secretary, Prof. Adolph Leué, I shall refrain from dwelling upon them, but will ask your careful consideration of the work of the Bureau as set forth in the Secretary's Report.

IMPORTANCE OF FOREST CULTURE.

The importance of forest culture is in no country better exemplified than in Germany, which to-day presents the most complete system of forest management of the world.

To Frederick the Great is due the honor of reclaiming, through systematic tree-planting, many millions of acres of sterile land and converting it into a garden of luxuriance and beauty. We are told by the historian that vast armies of stalwart men are raised upon soil that two hundred and fifty years ago would hardly support a flock of goats, and all this through the means of cultivated forests.

Prussia alone has more than 20,000,000 acres of systematically planted forests, more than 10,000,000 of which are owned and managed by the government, while all the private forests are under governmental control. This vast area of artificial forests employs the services of a Government Forest Director, 12 over-forest-masters, 100 forest-masters, 760 over-foresters, 3,646 foresters or overseers and a small army of laborers, and produces an annual revenue of over fourteen million dollars, or more than six and a half million above all expenses. But this vast sum of money represents but a small part of the real benefits which Prussia receives from her government forests. The healthfulness of her climate, the productive-

ness of her soil, in short, her greatness and prosperity depend largely upon her artificial forests.

In this connection let me say that nearly every government of Europe has large areas in systematically planted forests under their direct control and management.

Besides, Italy, Denmark, Austria, Prussia and Saxony have each one or more schools of forestry with great experimental stations attached, where young men are educated in the science of forest culture.

But it is said these countries have monarchical forms of government. The few have absolute power and are therefore able to make the necessary provisions for the restoration and conservation of forests, but in a republic the people are the source of authority, and if they do not see the dangers that threaten them the necessary legislation can not be had. It is true that laws will not be enacted much in advance of the general sentiment of the people—what must be done? Educate the people. Impress the people with the true importance of the subject. This the Ohio State Bureau of Forestry has been endeavoring to do, through its publications, and the Legislature and Governors through Arbor Day celebrations, till I feel justified in saying that public sentiment is so far advanced in this State, that it will look with great favor upon any measure calculated to further the objects of forestry. I have therefore read your recommendation in reference to the establishment of a chair of forestry in the Ohio University at Athens, and I congratulate you most heartily upon the sentiments you express.

The State Legislature can do no more important work, or any that will reflect more credit upon its members or upon the State, than to pass the forestry bill now before it, establishing a chair of forestry in the Ohio University in accordance with your message. It would be the most important step yet taken in this country for the advancement of its forestal interests, and *I know our people will approve.*

Respectfully submitted.

JOHN B. PEASLEE,
President State Forestry Bureau.

TREASURER'S REPORT.

Disbursements from November 16, 1888, to November 15, 1889.

1888.	
Nov.	21. Leo. Weltz, expenses
	21. J. Poindexter, expenses.....
	26. " "
	28. Adolph Leué, secretary, salary and expenses
Dec.	1. Leo Weltz, expenses.....
	13. " expenses at Atlanta
	13. J. Poindexter, expenses at Atlanta
1889.	
Jan.	16. J. B. Peaslee, expenses
	16. L. Weltz, expenses
Feb.	14. " "
	14. J. B. Peaslee, expenses
	14. A. Leué, secretary, salary and expenses
May	6. Jas. Poindexter, expenses.....
	6. Robert Clark & Co., binding reports
	8. A. Leué, secretary, salary.....
	11. Leo. Weltz, expenses
June	29. Jas. Poindexter, expenses.....
	29. J. B. Peaslee, expenses
	29. Adolph Leué, secretary, expenses and assistance.....
July	1. Leo Weltz, expenses
	3. Robert Clark & Co., stationery.....
Aug.	14. Leo Weltz, expenses.....
	14. J. Poindexter, expenses
	15. J. B. Peaslee, "
	15. A. Leué, secretary, expenses.....
	20. Leo Weltz, expenses
Oct.	1. A. Leué, secretary, salary
	29. J. Poindexter, expenses to Philadelphia, Pa
Nov.	1. J. B. Peaslee, " "
	1. Leo Weltz, " "
	1. A. Leué, secretary, " "
	Total.....
Nov.	15. Balance of appropriation.....

JAS. POINDEXTER.

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- I. Forestry in Ohio, by Adolph Leué.
- II. (1.) Journey of the State Board of Forestry through a portion of the Hocking Valley, by Adolph Leué.
(2.) Report of the State delegation to the American Forestry Congress, Philadelphia, Pa.
- III. Forestry Education—
 - (a.) Extract from the inaugural address of His Excellency, Gov. James E. Campbell. Forestry.
 - (b.) Copy of H. B. No. 186. A bill to provide for the establishment of a school of forestry at the Ohio University at Athens, Ohio.
 - (c.) Memorial on the bill.
 - (d.) Endorsements of the bill: Edgar T. Ensign, Prof. N. H. Egleston, Dr. Chas. Mohr.
- IV. Opinions on the necessity of providing for the instruction in the science and practice of forestry: Hon. John Sterling Morton, Prof. Edward Orton, Ph. D., Dr. Dan. Millikin, T. H. Charlton, Hon. Chas. Reemelin, Gov. John M. Thayer, Hon. G. W. Minier, Hon. Isaac Smucker, Judge Joseph Cox, Prof. Albert N. Prentiss, M. S., Cornell University, Prof. Selden Jennings Coffin, Ph. D., Lafayette College, Hon. A. P. Byal, Gov. James A. Beaver, of Pennsylvania, Hon. C. H. Grosvenor, M. C., Dr. N. E. Jones.
- V. Efforts for the advancement of forestal education in the State of New York—Schools of Forestry by D. D. T. Moore, Dr. Nichlas Jarchow.
- VI. The Necessity of Forests and Forestry, by Adolph Leué.
- VII. Roadside Tree-planting, compiled by Adolph Leué.
- VIII. New Method of Planting in the Forest, by Forestmaster Moritz Kozesnick, translated by Mrs. Conradine Adolph Leué.
- IX. General Observations on Forest Zoology, by Adolph Leué.
- X. The Rabbit.
- XI. The Mole.
- XII. The Hedgehog or Porcupine.
- XIII. Bats.
- XIV. Facts about Birds and their mode of living.
- XV. The Thrushes, by Dr. John E. Douglass.
 - (a.) The Brown Thrush.
 - (b.) The Catbird.
 - (c.) The Robin.
 - (d.) The Woodthrush.
 - (e.) The Mocking Bird
 - (f.) The Young Robin.
- XVI. Beech Tree Blight, by Dr. J. A. Lintner.
- XVII. The Absence of Trees from Prairies, by Prof. Daniel Vaughan.
- XVIII. Forestry as related to the General Government, and to that of States, by Dr. N. E. Jones.
- XIX. Succession of Forest Growth, by Robert Douglass.
- XX. Forests and Rainfall, by Cassius M. Clay.
- XXI. Forests and Rainfall, by Sylvester Fowler. Forests and Water-courses, Prof. N. L. Shalor.
- XXII. Tree Culture on Prairies, by Isaac Smucker.
- XXIII. Forest Planting in Virginia, by Burnett Landreth.
- XXIV. Wagon timber grown from seeds on the prairies of Illinois.

FORESTRY IN OHIO.

To the Honorable Board of Directors of the State Forestry Bureau:

GENTLEMEN: In submitting to you this, my Fifth Annual Report upon Forestry, let me briefly summarize the work of this Bureau during the year closed, and then call your attention to some of the more pressing needs of forestry. While in the first two years of its existence the work of this Bureau was investigative of the extent, distribution and condition of the forests in the State and of the causes of their decay, it has during the last three years, and more especially during 1889, been advisory and educational, and thereby "it has," in words of Prof. Sargent, "*justified its existence.*" The lamentable condition of our forests, and the causes of their gradual but sure decay, are so well known, that any further efforts to verify an accepted truth seems to be superfluous.

The great need of information in matters pertaining to forestry has been apparent for many years, but only to a few. It is only of recent time that the people begin to feel it, when failure attends their first efforts in practical forestry. The numerous letters of inquiry received during the past year relate to almost every department of forestry—from the gathering of the seeds and the raising of seedlings to the seasoning of the timber—from the planting of trees for honey to the planting for charcoal to be used for industrial purposes and in the manufacture of gunpowder.

Although, in some instances, it became necessary to institute special investigations, which the correspondents might well have made themselves, it has been my policy to furnish the desired information. More frequently the inquiries made were answered by sending a report and calling attention to certain articles contained therein. It is very significant that such inquiries are received not only from people of this State but from all parts of the Union, which shows that the influence of the Bureau is not limited to this State.

But greater and far more lasting has been the educational influence of this Bureau through the wise distribution of its annual reports, as is evidenced by personal letters, by newspaper reports, and by the re-publication of many of its articles in daily papers, in journals, devoted to agriculture and horticulture, and to the lumbering interest. Even in

Europe these reports are held in high esteem. By your direction nearly all that portion of the reports which were given to Mr. J. B. Peaslee and myself to distribute, namely, 1,000 copies of each volume, were bound and distributed to

1. All large public libraries of the country.
2. All public libraries of this State.
3. All State libraries.
4. All agricultural colleges of the land.
5. All agricultural experiment stations.
6. All the colleges and universities of Ohio.
7. All the largest colleges and universities of the country.
8. All the schools of Forestry in Europe.
9. The more important journals* of agriculture, of the lumbering interest and the wood-working industries.
10. Several rural associations.
11. Correspondents of the Bureau.

By this distribution the reports are accessible to millions of readers. True, the postage on them amounts to a considerable sum, yet it is admitted by even the most economical people that it is money well spent.

The demands for the reports of this Bureau are at an increase. A number of requests for copies could not be granted as the supply was exhausted or disposed of by order of your honorable Board. To supply such a former member of the Legislature kindly volunteered to turn his portion of Vol. I over to me.

A great agency in forestal education is the observance of Arbor Day. It is greatly to be regretted that the observance of the day has, during the last few years, been on the decline in this State. Ohio, the State in which *the School Arbor Day* originated in 1882, can ill afford to ignore this day, yet this is practically the case. In former years, the Ohio State Forestry Association made a special effort to secure the observance of the day in all parts of the State by organizing *State and County Arbor Day Committees*. The County Arbor Day Committees, at the request of the State Committee, organized township and local Arbor Day Committees. The cost of organizing these committees and of providing them with pamphlets and circulars relating to Arbor Day celebration was borne by the State Forestry

*Several of the journals who received reports kindly furnished me their papers regularly, thus affording me an opportunity to ascertain the results of the latest experience. I hereby gratefully acknowledge the receipt of

1. The Country Gentleman, Albany, N. Y.
2. The Ohio Farmer, Cleveland, O.
3. The Prairie Farmer, Chicago, Ill.
4. The Kansas Farmer, Topeka, Kas.
5. Farm and Home, Springfield, Mass.
6. The Northwestern Lumberman, Chicago, Ill.
7. The Timberman, Chicago, Ill.
8. The Lumber Trade Journal, Chicago, Ill.
9. The Wood Worker, Indianapolis, Ind.
10. The Mechanic and Builder, New York, N. Y.

Association, which also defrayed the expenses of the celebration in Cincinnati. For the past few years the State Forestry Association has done nothing in the matter, depending upon the State Forestry Bureau to do the work. In the last few years all other States celebrating Arbor Day* excelled Ohio. This ought not to be so. It will be well for this Bureau to take steps now to secure an Arbor Day Celebration in 1891, in every household of the State. If the meetings of the American Forestry Congress be considered an authority on forestal matters, we needs must consider the establishment of schools of forestry a necessity, for at each of its meetings it passed resolutions favoring the establishment of such institutions. The Ohio State Forestry Association, and later, the State Forestry Bureau, have not been slow to recognize the importance of such a measure. In each of my reports I alluded to this need, and I am not alone in advocating this matter. The agitation came to culminating point in the *Inaugural Address† of his Excellency, Governor James E. Campbell*, in which he recommends *the establishment of a school of forestry at Athens, Ohio*. The friends of forestry in all parts of the State and the Union very justly hailed this recommendation as the commencement of a new era in the history of the forestry movement in America. In due time, Hon. Guy W. Mallon intruduced a bill,‡ providing for the establishment of such an institution at the Ohio University. The bill was referred to the Committee on Colleges and Universities, and will probably come up for action at the next session of the General Assembly.

Another important subject for investigation and experiment, too, is forest-zoology. I have spoken of this on previous occasions, and more especially in the *third and fourth annual report*. A more extensive treatise on this question will be found in this volume. We need information regarding the occurrence of insects injurious to the forest, and the extent of their depredation; we should know all the friends of the forests, be they birds or animals.§ It has been asserted that in most parts of the entire country, the domestic animals do more injury to the forests than all other foes combined. From what I have observed, not only in this, but also in other States, I believe this statement to be correct. Let the farmers of

*Arbor Day is now observed in thirty-six States of the Union: Pennsylvania observing two, viz.: one in Spring and one in Autumn. See article on Meeting of American Forestry Congress, on another page of this report.

During the past year, several books on Arbor Day Celebration have been published, the last being "Harper's School Speaker, Book First, Arbor Day, etc.," by Dr. James Baldwin, which is much on the plan of Arbor Day Celebration Exercises, by Dr. John B. Peaslee, published in 1884.

†See copy of this portion of his address in another part of this report.

‡The bill, a memorial and several letters relating to the subject will be found in another part of this report.

§It is a fact worthy of notice, that some of the friends of the forest, for example the mole, are by most people considered foes, and therefore destroyed.

ANNUAL REPORT

Ohio understand that wood-pasture is a delusion, and he will not be slow to protect his woodland against the inroads of cattle and sheep.

From what I have said about the amount of work you will readily see that the present provision to accomplish is entirely inadequate. If the work is to be done at all, it should be done well, and to do this it certainly will at least require one man's entire time and undivided attention. This, of course, can not be done for so small an appropriation as is now at your disposal.

In conclusion, I desire to publicly thank all who kindly contributed the results of their valuable experience and investigation to this report. Special thanks are due to the press, which has always been ready to assist the Bureau in its efforts to solicit information and to promulgate the results of its investigation.

Respectfully submitted.

ADOLPH LEUÉ,
Secretary State Forestry Bureau.

A JOURNEY

—OF THE—

STATE FORESTRY BUREAU THROUGH A PORTION OF THE HOCKING
VALLEY ON AUGUST 7TH, 8TH, 9TH AND 10TH, 1889.

[By ADOLPH LEUE, *Secretary.*]

INTRODUCTION.—To more clearly ascertain the forestal relation of Southern Ohio, and to better understand the needs of forestry in that region than can be done by correspondence, the Board of Directors of this Bureau, at a meeting held in Columbus, June 29, 1889, decided upon holding its next meeting in that section of the State, and authorized Mr. Weltz to make the necessary arrangement for that meeting.

Early in August Mr. Weltz informed the President of the Bureau, Dr. John B. Peaslee, that every thing was ready for a meeting at Lancaster, Fairfield county, Ohio, and for a journey to the Ohio Reform Farm, located in that county. The President then set apart the 7th, 8th, 9th and 10th days of August, 1889.

FROM CINCINNATI TO LANCASTER.—The direct route between Cincinnati and Lancaster is the Cincinnati and Muskingum R. R., which, being operated by the Pennsylvania Central, starts from the Little Miami depot. As the Bureau was to meet in the evening of the 7th, Mr. Peaslee and myself took the train which leaves Cincinnati at 11:52 A. M., standard time.

The regions traversed by railroads are generally supposed to be well known, and so they are to people who live along or near such roads and, to some extent, to those who pass over it, but besides these there are very few who have a clear idea of the physical geography of such regions. It is a well known and, indeed, a remarkable fact that, as a general rule, the people of this country strive after a knowledge about distant lands rather than after an acquaintance with their own, always forgetting that to fully understand a foreign country we should be well acquainted with our own. This same longing after a knowledge of distant lands induces thousands of people annually to visit Europe, and, from my own experience with Americans abroad, I venture the assertion that not more than 10 per cent. of all who go to Europe have seen our Niagara, and that less than 5-

per cent. have ever been in the Yellow Stone Park. I also assert, that less than 30 per cent. of Ohioans, who travel in other States, have ever been through the picturesque region of the Hocking Valley and Southern Ohio.

In the modern way of traveling, that is on railroads, people can not see much of any thing, but little of many things. I do by no means despise traveling by railroads; it enables us to more readily obtain a general idea of the country through which we pass, than we could by traveling on foot or on horseback. Yet it has its drawback; people do not learn to make careful investigation which can only be made by proceeding slowly. An exact knowledge of home geography obtained by personal observation will greatly aid us to profit by the more rapid transit through the country. These last remarks are intended to place the following observations from the car window—in a proper light. They are general impressions which naturally follow in rapid succession.

We started on our journey, as already observed at 11:50 A. M. At Fulton, which we reached in about five minutes, we were delayed by an obstruction in the road, which was in the form of a fire-engine eng ged in extinguishing the fire of a burning frame building. The delay, however, was of a short duration; for at 12:15 P. M. we started, and reached Tusculum at 12:30. From the railroad, this place, which was so named by Mr. Joseph Longworth, does not present a very attractive appearance. (With but rare exceptions, the same is true of all that portion of Cincinnati which lies along the Ohio river.) The houses are mostly in a dilapidated condition, and the grounds are sadly neglected. Ornamental tree-planting is almost entirely unknown there; weeds and rubbish disfigure the occasionally neat habitations of man. The Hills of Tusculum, however, are a direct contrast to this; there cultivation and thrift is the rule, and neglect the exception.

North and northeast of Tusculum we get a glimpse of the country. On the left of the road, as we proceed towards the east, we have a chain of hills partly covered with forests, here and there a vineyard, and at the foot of these we observe some beautiful residences. On the right the broad valley of the Little Miami extends, showing unmistakable evidences of unexcelled fertility. Corn and wheat-fields present themselves to our eye. Here the denizens of Cincinnati come out in great numbers to escape the air and noise of city life.

The villages Sans Souri, Plainville, Lawrence and Terrace Park, all gems of beauty, are passed in rapid succession. The principal trees growing on the hills between these villages are oaks, of which the White oak predominates, and maples intermingled with some beeches, elms and Hackberry trees. In some localities the trees present a healthy appearance,

while more often, signs of decay, caused by vandalism, as girdling and burning, or by utilizing these woodlands for pasturing purposes, are plainly visible.

The banks of the Little Miami are lined with a dense growth of poplars, willows and sycamores.

At Lawrence, a small village, the most striking feature may be said to be the great number of dead or dying Black Locusts. Worthy of notice are the fine orange hedges at or near this place. The same is true of Terrace Park.

We are still on the right of the Little Miami which constitutes here the boundary line between Hamilton and Clermont counties. On the left of the river lies the thriving little town of Milford.

At 1:4 P. M. we reached Camp Dennison, a small village consisting of but a few, mostly one-story high frame houses, and three minutes later we crossed the Little Miami at Miamiville, Clermont county. This place lies 17.3 miles northeast of Cincinnati, and 102.7 miles southwest of Columbus.

The principal crops in this neighborhood are wheat and barley. The clover fields were exceptionally fine. Here and there we noticed tobacco fields.

The woods here, which are few and generally poor, are used for pastures, hence it is not surprising to see so many stag-horned* trees.

The hills along here vary in height from about 100 to 150 feet from the base.

Having passed Epworth Heights, a noted Methodist camp-meeting ground, which, by the way, is beautifully located, we reached Loveland, not a very large but an exceedingly beautiful village, having many ornamental trees. The people in this place are said to be very enterprising. The small patches of woodland in the vicinity of Loveland, although they do not fill the requirements of systematic forestry, are in a better condition than the woodlands between here and Cincinnati.

At King's Bridge, which is 29.3 miles northeast of Cincinnati, and which we reached at 1:32 P. M., we observed boys wading through the river, while the debris on the banks indicated that in rainy seasons the Little Miami assumes, even here, quite respectable proportions.

Between King's Bridge and South Lebanon there is a fine oak grove on the slope of one of the hills; but the hills, which are denuded of trees, present a very lamentable condition, the sides being furrowed by deep

* Trees are said to be *stag-horned* or *stag-headed* when the ends of some of the branches die and appear among the living wood; in the Oak the dead branches are often bleached to whiteness, and bear a fanciful representation to the horns of a stag.

gulleys washed out by the rain. Here, surely, is room for improvement, and great need for an often repeated and protracted arbor day.

At 1:45 P. M. we reached Morrow, where we branch off on the Cincinnati and Muskingum Valley Railway. The country now assumes the level character. Every thing is either corn field, wheat field or pasture; no waste land of any kind. Of trees we see but little, and what we see tells the story of want of interest in forestry. Dead trees and dying trees are the rule; of artificial plantations there is no trace. Although now and then we pass a small grove of tolerably good looking trees, but none are protected from the inroads of cattle.

The roads in this county (Clinton) are in an exceptionally fine condition, some of them being lined with shade trees, of which the Silver-leaved Maple is the most conspicuous. The old-fashioned worm or rail fence is still predominant, though board and wire fences are not uncommon.

At 2:40 P. M. we arrived at Wilmington, the county seat of Clinton county. Here Mr. Weltz entered on the train. Directly east of Wilmington lies Tharand.*

Several miles west of Washington C. H., Fayette county, the effect of the great hurricane which passed through this section of Ohio in 1885, and which caused the disastrous destruction at Washington C. H., are still visible. Most of the fine oaks and hickories and elms, which the hurricane tore up by the roots or broke off, or tore into shreds, have been cut and split into cord-wood, yet there are hundreds of them lying in the same position in which they were left by the hurricane. Such neglect to remove the prostrated wood is, to say the least, very imprudent, because such wood affords excellent breeding places for insects.

Let me introduce here Mr. T. J. Charlton, a man of weight and well educated. This gentleman presides over the Indiana Reform School for Boys, located at Plainville, Ind., and was on his way to Lancaster to visit the Ohio State Reform Farm near that place. Mr. Charlton and Dr. John B. Peaslee were old acquaintances, and had been renewing their acquaintance all the way from Cincinnati to this place. As we came in sight of Washington C. H. he turned to me, saying: "Do you know that Henry Ward Beecher was something of a forester?" Upon my answering this question in the negative, he said: "Yes, he was; he was a great lover of trees and a keen observer, and often drew a comparison between trees and men." Then pointing to some Lombardy poplars standing east of Washington C. H., he continued: "Those trees," he said, "are like an old bachelor, for they die first at the top and then grow ragged below. But

* This place was named by the State Forestry Bureau at the special request of its owner, vide Third Annual Report of this Bureau, page 14.

in this Mr. Beecher was wrong, for this poplar first gets ragged below and then dies at the top, and herein," Mr. Charlton concluded, "lies, I think, the resemblance."

Washington C. H., which we reached at 3:25 p. m., lies 74 miles northeast of Cincinnati. The soil in this region is exceedingly fertile.*

LANDS OWNED IN 1888.

Counties.	No. of acres cultivated.	No. of acres in pasture.	No. of acres in woodland.	No. of acres waste land.	Total No. of acres owned in 1888.
Fayette	100,516	80,693	22,160	1,256	205,105
Athens.....	44,892	118,488	49,944	14,096	226,166
Lawrence.....	42,870	45,351	38,251	28,445	160,970
Meigs	57,498	78,714	47,218	24,392	161,235
Scioto	63,776	35,251	73,125	23,470	195,522
Vinton	43,553	76,546	40,229	8,582	168,910

To this great fertility must be ascribed the rapid decrease of the forest area in the county (Fayette). Besides statistics and a few scattered records there are some visible evidences of the grandeur of the ancient forests in this region. I refer to the huge stumps studding the fields and the solid old rail fences enclosing them. The few small groves remaining (which cover a little over 22,000 acres of the 205,105 acres owned in the county) seem to serve as a shade for cattle and nothing more.

As we approach the Scioto River the forests are more numerous and denser, and consist chiefly of oak and elm trees. The land, which is marshy and at places swampy, presents a wide and almost perfectly level plain. At 4:10 p. m. we passed the Scioto River, and two minutes later we were at Circleville, which is 110 miles from Cincinnati.

Pickaway county, of which Circleville is the county seat, is said to be one of the most fertile counties in the State, but part of the land needs draining. Here, too, the farmer plows around the old stumps of trees

than remove them. About two or three miles east of Circleville noticed a beautiful oak grove of perhaps 15 to 20 acres in extent, the being from 8 to 12 inches in diameter and correspondingly high.

ear Stoutsville we saw a large drain-tile factory, and we were told

e above table which is compiled from the Statistics of Ohio will indicate the fertility of soil county as compared with others.

that there are several other large factories of the kind in the county, and yet that the demand exceeded the supply.

Amanda, which is a small village containing some very pretty houses, seems to be a distributing point of lumber, for near the station we saw several large lumber yards.

We have now reached the terminus of the level plain of the Scioto Valley, and are on the divide between the Scioto and Hocking Rivers. The land is wet. The hills which rise from 25 to 100 feet above the railway level are mostly clothed with trees. The country becomes more picturesque.

At 5:15 P. M. we reached Lancaster, having been on the road 5 hours, 23 minutes.

Fairfield county is situated in the northern part of the Hocking Valley. It is bounded on the north by Licking county, on the east by Perry and Hocking counties, on the south by Hocking and Pickaway, and on the west by Pickaway and Franklin. The county was formed on December 9, 1800, by proclamation of Governor St. Clair, and was named from the beauty of its *fair fields*. The western and northern parts of the county present all the characteristic features of Central Ohio, *i. e.*: It is level or nearly so, and exceedingly fertile, the soil consisting of rich loam with a subsoil of clay; the middle and a part of the eastern portion is undulating, the soil good, consisting of a clayey loam mixed with vegetable mould; the southern part is very hilly and broken. The valleys among these hills are very attractive, not only for their fertility, but as "gems of landscape beauty."

Drainage.—The northern townships, Walnut, Liberty, and Violet, are drained by Little Walnut creek, which empties into the Scioto in Pickaway county. The portions of Bloom, Amanda and Clear Creek townships, which lie on the western slope of the water-shed between Hocking and Scioto Rivers, are drained by streams flowing into the Scioto. The Hocking River is, at Lancaster, not much of a stream, formed by the drainage of Greenfield township; near the city, it receives the waters of Fetter's, Baldwin and Pleasant runs, which rise in Pleasant township. The townships Richland and Rush Creek, are drained by Rush creek, which flows in a southerly direction into Marion township of Hocking county, thence westerly into Berne township, Fairfield county, and empties into the Hocking a little below Sugar Grove. Clear creek, which rises in Amanda township, flows through the northeast corner of Clear Creek township, and through nearly the center of Madison, and empties into the Hocking River in Hocking county.

LANCASTER, the county seat, is situated on the Hocking River at the Hocking Canal, lies twenty-eight miles southeast of Columbus, a

125 miles northeast of Cincinnati. Lancaster is an enterprising and rapidly growing city. In 1840 it had 2,120 inhabitants; in 1870 it numbered 4,725, and in 1880, its population had reached 6,802. Since that time the place has become quite prominent on account of its natural gas wells, and in consequence thereof has experienced an unprecedented influx of people. We were assured that the census of 1890 would show an increase of 3,000. When the officials and owner of the gas well "The Old Man Himself," Mr. Theodore Mithoff, learned of our arrival and desire to see the gas wells lit, we were invited to witness the sight. And, indeed, a grand spectacle it was. I had read several descriptions of the grandeur of such a spectacle, and had raised my expectation to a very high pitch, but yet it was far short of the reality. Although the streets of the city are lit by natural gas, and attempts are made to use it for illuminating purposes in the houses, the artificial gas is still in use. Natural gas has superseded coal and wood for fuel. It is used in foundries and in machine shops, in the kitchen and in the parlor.

FROM LANCASTER TO DAVID TALMADGE'S OLD HOMESTEAD—Early in the morning of August 8 (Mr. Poindexter had not yet arrived), Dr. John B. Peaslee, Mr. Weltz and the writer went out to examine the ornamental plantation on the David Talmadge old homestead, now owned by Mr. H. A. Mithoff. The road that leads from Lancaster to that place, is known as Circleville pike. All who are opposed to roadside tree-planting should go and see this portion of Circleville pike, and if they do not become converts to roadside tree-planting, I fear they never will be. The two rows of trees do not stand on the road, but on the edge of the fields adjoining it, yet they shade the road completely. On the one side is a row of willows, *Salix aurea*, and on the other, one of sycamores, *Peltanus occidentalis*. These trees, Mr. Weltz said were planted twenty-four years ago, and at that time were about six years from the cutting. The trees are about all of the same height and dimensions. We measured several of them and found the following result: Sycamore, ten feet six inches in circumference, with a height of seventy feet. Willow, nine feet eight inches in circumference, with a height of sixty-five feet. As these trees had the impudence to shade not only the road but also the field, and thereby diminishing the yield of corn near the road, they became an

omination in the eyes of a certain owner of the field, whose æsthetic education must have been sadly neglected, for last year (1888) he cut down his portion of them. We measured the stumps and found the following diameters: No. one, thirty-five inches; No. two, twenty-nine inches; No. three, thirty inches; No. four, thirty-one and one-half inches; No. five, thirty-two inches; No. six, thirty-one inches; No. seven, twenty-eight inches. We also measured two honey locust trees (*Gleditschia tri-*

(*canthos*) standing in a pasture near the road, and found the following circumference: One, ten feet five inches, the other, nine feet seven inches.*

We now entered the premises of Mr. Mithoff. The first tree we measured was an American elm, which had a circumference of fifteen feet. Around a pond where the ground was swampy we measured a cypress, which was planted by Mr. Weltz in 1864, and which was then about four years old and which now had a circumference of six feet. An *Abies alba* which was of the same age and in the same soil measured thirty seven inches in circumference; *European Larch*, of the same age, had a circumference of thirty-three inches; *Arbor Vitae*, circumference thirty inches; *Norway Spruce*, circumference, four feet three and one-half inches; *Silver-leaved Maple*, in the same group and of the same age, circumference eight feet nine inches; *Balsam Fir*, circumference twenty-five inches. Two *Cucumber Trees* measured, one thirty-seven inches, the other thirty-eight inches in circumference. A *European Alder* measured six feet in circumference. On the higher ground, which was laid out very beautifully, we found forest trees of native growth of considerable size; the *Chestnut Oak* being preponderant, one measuring eleven feet seven and one-half inches. A *Cypress* was found to have a circumference of fifty-eight inches. A *Burr Oak* of nine feet nine inches. A *Honey Locust* had a circumference of fifty-nine and one-half inches.

Joining Mr. Mithoff's place, on a creek called Hunter's Run, we found an ancient American elm, which we estimated to be about ninety feet high. At five feet from the ground it had a circumference of nineteen feet seven inches, and at one foot from the ground, twenty-two feet six inches; the largest diameter was found to be six feet five inches. This tree stands quite isolated in a pasture and is nearly dead.

It was about ten o'clock when we returned to Lancaster. In the meantime the train from Columbus had arrived and brought Mr. Poindexter. We then entered the carriage, which had been sent to convey us to the State Reform Farm.

The land between Lancaster and the Reform Farm is very hilly, the road rough and thus difficult of travel, so that it took more than an hour and a half to reach the farm, which is about six miles from Lancaster. On our way we had a good opportunity to notice the arborical vegetation of the region through which we passed. The predominant tree is undoubtedly the chestnut, the oak, especially the chestnut oak, then follow hickories, beech and maple—of the latter we saw magnificent specimens—then the pitch pine, black walnut and ash; we also noticed some fine burr oaks, black locusts—the latter seemed to be in a tolerably good condition, espec-

* The trees were all measured at three and one half feet from the ground.

ially where they occurred at the outskirts of dense forests—birch and gum trees were not rare; in the woods along the road there were also hemlocks, also several fine specimens of the cucumber tree and of the honey locust. All along the road we witnessed the evil consequences of forest destruction. The hills of this region, which are of the sandstone formation, were originally covered with dense forests. Since these were removed, the successive rains have washed the thin layer of soil which, in some instances, is not more than a foot or a few feet deep, down into the valleys, and laid bare the rocks. There are now near the road on which we traveled, several tracts of from about two to eight acres in extent utterly void of soil, and thus entirely useless for agricultural purposes. Here and there the hill-sides have been turned into vineyards and, it is said, are made very profitable. There are also fields which have been abandoned because of their infertility. These are now occupied by briars and thistles.

The Ohio State Reform Farm, which is presided over by Capt. David Barrett, is one of the best managed institutions of the State. Originally (it was purchased by the State in 1857) it contained 1,170 acres of just such lands as I have described. The grounds surrounding the several buildings are tastefully laid out and well kept. The remainder of the land is partly used for the raising of the ordinary farm crops—partly it is in orchards and vineyards, but a very large portion is in forests. These latter are, of course, under no systematic management, and thus no efforts are made to derive any profit from them. The question *whether it would not be wise to turn the woodland into a forestal Experiment Station* was discussed by the directors of the Bureau and Capt. David Barrett, the able Superintendent, and the prevailing opinion was, that it would be exceedingly practicable and give the boys of the farm an opportunity to learn practical forestry.

Under the able leader, Capt. Barrett, the members of the Bureau visited the orchard and vineyard of the institution. These parts of the farm which are said to have been very productive have, in the course of time, deteriorated and are badly in need of a good application of fertilizers. It was thought that several thousands of dollars spent for fertilizers would be a profitable investment.

The several workshops and school-rooms were visited, all of which are evidence of the admirable management of the institution.

Upon our return to Lancaster we took the train for Logan, Hocking county.

Logan, the county seat of Hocking county, is situated on the Hocking River and Canal, and lies about one mile below the great fall of the Hocking River, and 18 miles below Lancaster. It is a small town with some

exceedingly fine buildings, and not without evidences of thrift of its inhabitants.

August 9, 1889.—At 6:30 A. M. we left Logan and traveled in a westerly direction over Gibsonville road towards the famous Rock-house. The country about here, as is the entire Hocking Valley, is very hilly. The roads on which we traveled were, with rare exceptions, in a miserable condition. Near Logan we noticed an exceedingly fine grove of oaks, mixed with chestnut trees and hickories. This grove, unlike most remnants of the forests in Ohio, presented a very creditable appearance. The trees which were straight and tall did not show the signs of decay so common in all parts of the State. Here we saw oaks, the trunks of which measured three feet in diameter. Scarcely two miles west of Logan the "cleared" country commences. Here, if any where, the clearing has been complete. Any one desirous of seeing the effects of forest destruction upon the soil which, at this place, has been gullied out, should travel from Logan to Gibsonville, and if he be not convinced that he is in a little desert, we fear that nothing will convince him. Some of the denuded hillsides do not show the slightest trace of vegetation. Here, on the ridge of a chain of hills, we looked to every point of the compass to see whether we could not find a herd of cattle or sheep, but in vain. Of this region it might truthfully be said that "*a goat would starve on a ten-acre lot and a mule would breed a famine.*"

About two miles east of Gibsonville we see here and there small patches of trees, of which several kinds of oaks are the most predominant. Hazelnuts grow along the road. A very peculiar feature in this region was the great abundance of the "Flowering Spurge" (*Euphorbia corollata*), and the "American Century" (*Sabbatia brachialata*), which cover whole fields. Just before we reached Gibsonville we noticed the Black Locust tree (*Robinia pseudacacia*) along the road. These seemed to be perfectly sound, but upon closer examination we found the traces of the locust borer (*Clytus Robiniae*). West of Gibsonville we saw a thrifty grove of Black Locust trees which had, at all appearance, not suffered much from the borer. We passed several groves consisting of oaks, chestnuts, hickory, maple, (sugar) and cucumber trees, and at some distances small undergrowth of forests were seen.

At 9:30 A. M. we reached the Rock-house the extent of our journey in this county. After a short rest we went into the woods which are here in a kind of primeval condition. Oak trees with a diameter of from two to three feet are not rare. Chestnut trees are still larger; we measured one which, at three feet from the ground, had a circumference of sixteen feet six inches. An oak tree, which had probably been blown down by a

hurricane, had a diameter of two feet at the base and measured fifty-two feet to the first limb.

The attracting feature of this place is the cave, known as the "Rock-house," which Prof. Gilbert describes as follows.*

"The Rock-house is a magnificent corridor, or arched room, of great length, high up in the cliff, having on one side the solid rock, and on the other, towards the face of the cliff, six vast columns, which have been rounded and shaped by water and frost. The cliff at this point is 115 feet high. In this region, and especially along the banks of Queer Creek, is the most picturesque scenery to be found in Southern Ohio. The stream flows through the Waverly Conglomerate. In this immense deposit of sand-rock it has cut channels, undermined cliffs and excavated tunnels. Occasionally it plunges abruptly over a fall of nearly a hundred feet to gather its shattered waters together again and flow smoothly through a narrow valley which the water has cut from the solid rock. The rock assumes the most fantastic shapes. Here it is a perpendicular cliff, capped with evergreens, there it is an overhanging shelf, forming a roof to shelter cattle or grain. Every turn of the road presents new features of the scenery. Perhaps the most famous of the strange formations in this region is the Rock-house above described."

Mr. Peaslee and myself measured the length of the cave and its width at different points; unfortunately the data of these measurements are lost, but its length was, if my memory serves me right, 276 feet. Our interest in this cave was increased when Mr. Weltz informed us that Dr. Warder had been in it and inscribed his name on the wall. We looked for it but did not find it. On the cap of the cave, near its edge, we found the Trailing Arbutus (*Epigaea repens*, L.)

After dinner the Bureau held a regular meeting for transaction of routine business under an exceedingly fine and unique oak tree, which has been described by Dr. John A. Warder, and which, in honor of him, the Bureau named *QUERCUS WARDERI*.

At 2 P. M. we started back to Logan, taking the so-called Prairie road. On our way, about twelve miles west of Logan, we saw deadened forests, showing that this abominable practice has not ceased to exist in Ohio. Wherever our eyes turned we observed a harsh treatment of forests. People seemed to be perfectly unconcerned about the consequences of forest destruction.

The great need of reform in matters pertaining to forestry is apparent every-where in this county. In consideration of these alarming conditions the Bureau recommends to the people of this county, and of all

*Geological Survey of Ohio, 1870, p. 88.

other counties similarly situated, that no time be lost in reforestering these denuded regions, and suggests that the *Catalpa Speciosa*, properly intermixed with oaks and chestnut, be planted in all such regions, and above all urges that the forests be protected against the inroads of domestic animals.

FORESTRY EDUCATION.

EXTRACT FROM THE INAUGURAL ADDRESS OF HIS EXCELLENCY,
JAMES E. CAMPBELL, GOVERNOR OF OHIO.

[Delivered at the Capitol, Columbus, Ohio, January 18, 1890.]

FORESTRY.

The subject of forestry is one of great interest. The State Forestry Bureau, established in 1885, has done valuable work, but its mission is practically ended. While commanding it for what it has done in the past, a different method is demanded for the future. It is thought by those best versed in the matter that the sum heretofore appropriated for the Forestry Bureau might be more judiciously expended in endowing a chair of forestry, or a joint chair of forestry and mining at the Athens University, which is located in a section where forests are needed and mining extensively carried on. It is hardly necessary to say that the forests of Ohio have been destroyed during the past few years at a rate exceeding the destruction of forests any where in the world, save in purely lumber-producing regions, and there is in many counties a smaller percentage of forest lands than in the most crowded parts of Europe. For this reason the cultivation and preservation of trees is a matter of importance, and is well-worthy your attention.

A BILL

To provide for the establishment of a School of Forestry at the Ohio University, at
Athens, Ohio.

SECTION 1. *Be it enacted by the General Assembly of the State of Ohio,* That there be and hereby is established at the Ohio University, at Athens, Ohio, a school of forestry as a department of said university, in which the science and practice of forestry shall be taught.

SEC. 2. It shall be the duty of the trustees of the aforesaid university, to provide for this department a lecture room, a laboratory, and rooms for a forestal museum; to point, as soon as possible, a professor of forestry; to secure a suitable tract of land for forestal experiment station, of which the professor of forestry shall be the director.

SEC. 3. For the equipment of this school of forestry, and for the maintenance of the same for the ensuing year, there is hereby appropriated the sum of fifteen thousand dollars (\$15,000), or so much thereof as may be necessary for the purpose of meeting the actual expenses of carrying out the provisions of this act.

SEC. 4. No money shall be expended, except on order of the president of the board trustees direct, or by the executive committee of the board.

SEC. 5. This act shall take effect and be in force from and after its passage.

MEMORIAL.

To the Honorable Senate and House of Representatives of the Sixty-ninth General Assembly of the State of Ohio, greeting:

In reference to House Bill; providing for the establishment of a School of Forestry at the Ohio University, at Athens, Ohio, the undersigned most respectfully begs leave to submit to your favorable consideration as follows:

No one who has carefully studied the extent, distribution and condition of our forests, and who has inquired into the prospect of a renewal of the same in the State of Ohio, will hesitate a moment to assert that there is a great need of instruction in the science and practice of forestry, and that to provide for this need is an absolute necessity.

Elsewhere* I have shown that the objection that, in this country, there is no need of trained foresters, is not based upon a knowledge of the extent and true condition of our forests, but rather upon a profound blindness to the best interest of our land.

The consideration of the gradual but steady decrease of our forest area and the constant deterioration of existing woodlands, through mal-treatment, can not but strengthen the conviction that we stand badly in need of a corps of men well trained in the science and practice of forestry, men who shall instruct the people in matters pertaining to forestry, men who shall redeem the waste lands—now practically unproductive—by creating artificial forests.

The difficulties of reforesting naked hill-sides, such as we observe in Southern Ohio, in the Hocking Valley and in the river counties of Eastern Ohio, increase year after year, and, unless we heed the old saying “delays are dangerous,” the time is not distant in which a successful reboisement shall be impossible in many places.

Almost in the center of the region referred to lies the town of Athens, the seat of the Ohio University. In its immediate vicinity are wooded hills and naked hills, sandy valleys and fertile valleys, in short, every variety of physical conditions of soil is represented, affording the most varied opportunities for observation and experiments. Here, at the Ohio University, Governor James E. Campbell declares the School of Forestry should be located, and, indeed, the recommendation is a wise one, for there is no place in Ohio better adapted for such an institution than Athens.

The State University, at Columbus, and Miami University, at Oxford (both State institutions), may be able to offer certain advantages, but taking into consideration that both of these institutions are located in a region where, probably, all forestal operations will be confined to the raising of wind-breaks or shelter-belts, where the student will have little or no opportunities to study forest-culture under difficult and trying conditions, such as are found near Athens—we are lead to the question: *Will the student who acquired his knowledge of Forestry at Columbus, or at Oxford, be a successful forester, should it be required of him to reforest the naked hills of Southern Ohio?*

I venture to answer, NO!

On the other hand, it will be admitted, that the student who has been trained in the science and practice of forestry under the conditions which Athens affords, will surely not fail to be successful should he be called upon to practice forestry in the fertile regions of Franklin and Butler counties.

Although any money judiciously expended by the State to advance the cause of forestry will be an investment which will bear an interest greater than perhaps any investment that could be made by the State, yet there is no reason why economy should not be practiced wherever it is possible. An opportunity for such economy is offered in locating this School of Forestry. A very valuable, indeed an indispensable adjunct to a School of Forestry, is a school-forest in which, for the purpose of illustration, the actual operations in practical forestry should be performed. A tract of woodland of about

* Compare Report of Ohio State Forestry Bureau, Vol. I, pp. 2a 23, Vol. II, p. 14, Vol. III, p. 1, Vol. IV, pp. 6-10.

hundred acres should be acquired by the State and be placed under the administration of the school. In addition to this a tract of waste lands should be bought for the purpose of instituting comparative experiments in the methods of reforesting. This school-forest should, in the course of time, comprise an area of at least 1,000 acres.

According to the valuation by the Board of Equalization such a tract of land would represent :

In Franklin county.....	\$41,600 00
In Athens county.....	13,010 00

Or a saving of \$28,590 in favor of Athens.

In view of these facts, there can be no doubt as to the wisdom of the Governor's recommendation to locate the School of Forestry at Athens, Ohio.

Those of us who have studied the Forestry question of Ohio in all its bearings upon the prosperity of the State, and who have made extensive inquiries into the needs of forestry, are convinced that *nothing is better calculated to promote the forestry interest of Ohio than the enactment of the bill in question.*

WHEREFORE, We pray that Your Honorable Body will give this subject the attention which its importance demands.

Most respectfully, your obedient servant,

ADOLPH LEUE.

INDORSEMENTS OF THE BILL.

The friends and advocates of forestry in Ohio looked upon the bill with unusual favor, and wrote to their Representatives in the General Assembly of Ohio asking them to vote for the bill and to labor for its passage. The daily papers discussed the measure, pronouncing it the "most effective measure for the promotion of forestry." The bill was commented on favorably by the press of other States.

The following three letters, of which copies were laid before the committee on colleges and universities, need no comments:

STATE OF COLORADO, OFFICE OF FOREST COMMISSIONER,
COLORADO SPRINGS, February 19, 1890.

Prof. Adolph Leue, Cincinnati:

MY DEAR SIR: Your recent favor is at hand. I had before seen some notice of the proposed School of Forestry in connection with the Ohio University. I most heartily wish the undertaking success. The idea is an excellent one and should be fully carried out. The time is not far distant, in my opinion, when the demands of forest administration in this country will require the services of educated and skillful foresters. That we have none now goes without saying. Again, I wish you Godspeed in your laudable endeavors.

I am sincerely yours,

EDGAR T. ENSIGN.

Col. Edgar T. Ensign, Forest Commissioner of Colorado, and one of the Vice Presidents of the American Forestry Congress, is a man of sound judgment and exceedingly practical. His views are of weight wherever he is known.

U. S. DEPARTMENT OF AGRICULTURE, FORESTRY DIVISION,
WASHINGTON, D. C., February 20, 1890.

Prof. Adolph Leue:

DEAR SIR: I am glad to know that there has been introduced into the General Assembly of Ohio a bill to provide for the establishment of a School of Forestry at the Ohio University at Athens, and I hope nothing may prevent its passage. Your own reports show that less than forty years ago more than half the area of Ohio was covered with trees. Now the forest area of the State is less than 17 per cent. Ohio has passed the danger line in the consumption of her forests, and it is time for her to take effective measures to arrest the further depletion of her wooded area, and to restore the timber in many places from which it has been removed. You have more than half a million of acres reported as unimproved land. What better use can be made of this than to clothe it with valuable timber, making it a source of revenue instead of allowing it to lie profitless as now, while it would be beneficial to the agricultural interests of the State in various ways. The time has come for the scientific culture of trees as well as of our ordinary farm crops, and we need professors of forestry as well as professors of agriculture.

France allowed her forests to be swept away, and she has already spent \$30,000,000 in the effort to repair the damages thereby occasioned and to restore the country to its former condition. She appropriated for this purpose last year 2,223,800 francs, and for her whole forest service 15,486,500 francs, or about \$3,000,000, and France is only about five times as large as Ohio. The German state forests exceed in area by only a third the existing forests of Ohio, yet in 1886-7 the German budget assigned for forest administration was \$7,392,785, and the income from the forests was \$13,344,520, or \$5,951,735 above all expense incurred.

If the bill for the School of Forestry at the university becomes a law, it will require only a few years to show that no chair in any college of Ohio has rendered a more valuable return to the State than that of the professor of forestry, for which the bill provides.

Yours sincerely,

N. H. EGLESTON.

Prof. Egleston, late chief of the U. S. Forestry division and recording secretary of the American Forestry Congress, is one of the foremost advocates of forestry in America, and knows whereof he speaks.

MOBILE, ALA., February 21, 1890.

MY DEAR PROF. LEUE: My best thanks for your kind letter of the 16th instant. It gives me much pleasure to see you untiring in your efforts to promote the cause of forestry in your State. In no other State in the Mississippi Valley would the establishment of a School of Forestry be of greater benefit than in Ohio, which, originally endowed by nature with boundless forests of the greatest economic importance, presents to-day the greatest reduction of its forest area among her sister States, and suffers already from the evils on the wake of the heedless destruction of its forests. To be the first amongst them to recognize the duty of the State to provide for the maintenance and restoration of its forests, and, thereby, for the welfare of this and the coming generation, would greatly to the honors of the State.

In connecting with one of her chief educational institutions a School of Forestry, the State will establish a safeguard for the permanent protection of its highest interest—the interests of agriculture, of industry and of commerce, and establish a shining example that can not fail to inspire with courage and incite to renewed efforts all engaged in laboring for the preservation of the forests of our country.

Hoping that the bill now pending in your Legislature will meet the desired success, and that you will also succeed in your efforts to establish the experimental station spoken of in your former letter, I remain faithfully

Your friend,

CHAS. MOHR.

Dr. Charles Mohr, State Botanist of Alabama, and Vice-President of the American Forestry Congress, is, without doubt, the best authority in forestry in the Southern States. He was one of the chief workers on the forestry census report of 1880, and has a world-wide reputation.

OPINIONS ON THE NECESSITY OF PROVIDING FOR THE INSTRUCTION IN THE SCIENCE AND PRACTICE OF FORESTRY.

During the summer of 1889, I addressed a number of men of high standing in political economy, education, science in general and in forestry, soliciting their views regarding *the necessity of providing for the instruction in the science and practice of forestry.*

The following are the replies received:

ARBOR LODGE, NEBRASKA CITY, N.EB., August 5, 1889.

DEAR SIR: The necessity of providing for instruction in scientific and practical forestry is so obvious that I can think of no statement that would be good and new, too, with which to drive it into the money-blunted brain of this *woodland-wasting generation.*

Every body knows that going out into a heavy down-pour of rain insures a wetting, and all students know that the complete denudation of valley and mountain and plain on this continent causes infertility, long drouths, disastrous floods, and at last desolation and death for our race. The fate of the Orient will be repeated in the Occident unless we conserve and plant forests.

Yours,

J. STERLING MORTON.

To Adolph Leué, Cincinnati, O.

REMARK: Ex-Governor J. Sterling Morton is the originator of Arbor Day.—A. L.

STATE GEOLOGICAL SURVEY,
COLUMBUS, O., August 5, 1889.

Adolph Leué, Secretary State Forestry Bureau, Cincinnati, O.:

DEAR SIR: In reply to your letter, I have to say, that I consider the necessity of ruction in practical forestry an urgent and important one. What the State most ls is an object lesson in forestry. A few hundred or thousand acres of our cheap ls should be applied to this use. No investment that the State can make will return nre a dividend when a term of twenty-five to fifty years is taken into the account.

To initiate and support such an enterprise, renders necessary instruction in forestry. As the minds of our people now seem to be, I see no great advantage in simply lecturing on the advantages of forestry. What is needed, in my judgment, is the demonstration of the practicability of the work.

Very truly,

EDWARD OREN,
State Geologist.

HAMILTON, O., August 5, 1889.

MY DEAR SIR: We have just completed our destruction of the forests of Ohio. This frightful work seemed to be necessary under the circumstances, and by that I mean that it was inevitable. The forest fell because it was a lurking place of vermin and of the red man. It hindered cultivation, and it limited the growth of grasses, which make valuable pasture. It made the whole country swampy, and it made the construction of roads a difficult task; it obscured the distant view, and in every way it isolated the pioneers, and overwhelmed them with loneliness.

That the forest tempered climate, the pioneers did not know, and could not know that one-fourth of the whole extent of forest should have been spared; this is our wise afterthought, and retrospective knowledge is very cheap.

Had you and I been here seventy-five years ago, we would have fought the forest with fire and axe, merely to have breathing room, and merely to make ourselves safe. Had we been here fifty years ago, we wise foresters would have had so little foresight that we would have rejoiced in a market for forest products, and we would have continued the destruction of the woods for the sake of wood. Had we been farming on well timbered farms only twenty-five years ago, we (most of us) would have cleared new fields recklessly for the sake of availing ourselves of the stored humus and potassium salts in the "new ground."

We have only ceased the most active destruction of the forests, and are only beginning to contemplate the construction and re-construction of our forests. We are like a baby, which, at a certain stage of its existence, will knock down a pile of blocks with the greatest enthusiasm, but can not be induced to put one block upon another.

Our ignorance in all forestal matters is great. Men in Ohio, who are very wise about field crops and domestic animals, positively do not know how to put a tree in the ground to grow. They know nothing of the adaptation of species to soils and to localities. They know nothing of the distances at which trees ought to be planted, and they are profoundly ignorant of nursing, of thinning, of pruning, and of all the details of forestry.

Such, then, being the extent and the density of our ignorance, what need is there for me to say that there is need of instruction? Such being the need of instruction, what need is there to speak of the need of an instructor? Instructors should certainly be provided, and an instructor should certainly be provided for.

As much as any man, I resent the idea of a paternal government to look after every little detail of life. I would have a simple government, and the less government the better. But I say that a State which has a commissioner to look after insurance companies, and keep them within the bounds of the law and their charters, a State which inspects steam boilers, a State which restrains pharmacists and physicians, and which regulates the manufacture of illuminating gas, that State can not consistently refuse to look to the forests of the State, to preserve them, and to re-establish them.

This work can not be done—it can not even be begun, without the dissemination of knowledge of trees, and masses of trees. And that precious knowledge can not be disseminated save through able instructors.

Then you are answered, my dear Mr. Forester. The need of an instructor goes with the great need of instruction.

OHIO STATE FORESTRY BUREAU.

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Aside from his teaching, I would gladly see an instructor in forestry well maintained, so that, by virtue of his office he might continually suggest to the public that there is such a noble and important art as forestry; aye, and a science too—one worthy of the worthiest.

I am sorry to write in such a haste. If I do not make myself understood, pray quiz me again.

Sincerely yours,

DAN. MILLIKIN.

To Adolph Leue, Secretary Ohio State Forestry Bureau, Cincinnati, O.

REMARK: Dr. Dan. Millikin, who is well known to the readers of the Ohio Forestry Reports, is one of the few men who commenced their labors in the interest of forestry, in the earlier period of his life, and, what is more, kept up this interest.—A. L.

INDIANA REFORM SCHOOL FOR BOYS,

PLAINFIELD, IND., August 21, 1889.

Prof. Adolph Leue, Secretary State Forestry Bureau, Cincinnati, O.:

DEAR SIR: You ask my views as to the "Need of providing for the instruction in the science and practice of forestry?" I answer that in my judgment there is a great need for such instruction.

Our forests are fast passing away through needless waste. Our prairies have lost their small belts of timber which they once had here and there. The times are ripe for an awakening of a public interest in forestry. If each State could secure lecturers to address the various educational institutions, it would do much good. This should be followed by a course of instruction. How this can be provided I am not prepared to suggest, but your experience and that of your colleagues on the Forestry Bureau of Ohio fit you to outline a course to pursue that would be practical.

Yours truly,

T. H. CHARLTON, Superintendent.

DENT, O., September 16, 1889.

DEAR MR. LEUE: I find that I shall have no time to write the article you request by your favor of August 1. I am busy in writing my life, and will need all my spare time now for revision of the manuscript. One idea I can suggest to you; it is: that a State that has forest-culture proves, *eo ipso*, that it is disposed to be provident. And the counter proposition is also true: A State without forest-culture is improvident, *i. e.* barbarian.

Truly yours,

CHAS. REEMELIN.

REMARK: Hon. Chas. Reemelin, who is an acknowledged authority in Political Economy, is one of the most ardent advocates of reform in matters pertaining to our forestry interest.—A. L.

STATE OF NEBRASKA, EXECUTIVE DEPARTMENT,

LINCOLN, September 15, 1889.

Adolph Leue, Cincinnati, O.:

DEAR SIR: Yours of August 31 was duly received. I am in favor of every measure designed to promote the raising of trees and the protection of our forests.

Very truly yours,

JOHN M. THAYER.

REMARK: Gov. Thayer is not a man of many words, but of deeds. His influence upon the forestry interest in Nebraska has made itself felt every-where.—A. L.

MINIER, ILL., September 8, 1889.

DEAR FRIEND LEUE: "I will go a thousand miles to see a man who can tell me something he never learned." So said a learned man, a scholar, and the president of a college in my hearing. Does any one doubt the truth of this observation? I suppose not. But how few of our colleges and universities act up to this truth! Schools established for mere mental training will never meet the necessities and the requirements of the American Nation. We are not to be confined to the ruts of the schools of the older nations. We have agricultural colleges or universities in all the States, but they are treading in the footsteps of the old colleges, or, at least, fast tending thitherward. All honor to the colleges and universities. But something more practical must be taught. Agricultural colleges should not come down to the mere technicalities, the verbiage and the shibboleths of the church, the law and the schools. The truth is patent, the knowledge of trees, their utility and the art of tree-planting should be taught in our common schools. Warm the substratum of the air of rooms, and the genial influence will rise of its own volition to the higher. So educate the masses in our common schools, and the colleges will be compelled to teach the science and art of tree-planting—forestry.

Only about one boy or girl in twenty ever graduate at colleges, so our common schools are nineteen times more important to us than are our colleges. I am more than pleased, I am delighted, with what you are trying to do in Ohio. May heaven's blessings attend your labor.

I will end my letter by quoting the seventh and eighth resolutions adopted by our Forestry Congress at its meeting in Denver, Colorado, in 1886:

Seventh. That the principles of forestry and practice of tree-planting should be taught in the public schools, normal schools and agricultural colleges of this country, and that we urgently recommend suitable legislation to that end in the several States and territories.

Eighth. That in our opinion the agricultural colleges of the various States should give special attention to the propagation and cultivation of forest trees, and especially for the purpose of determining the most useful and robust varieties of timber for their respective States and for the various portions thereof—and for the proper dissemination of the knowledge so obtained.

Yours for forests,

GEO. W. MINIER.

REMARK: Hon. Geo. W. Minier is an ex President of the American Forestry Congress, and for years has been an ardent student of forestry and a successful arboriculturist.

NEWARK, O., August 25, 1889.

Mr. Adolph Leue, Cincinnati, O.:

MY DEAR SIR: I suppose it is scarcely necessary for me to say to you, either with voice or pen, that I attach very much importance to forestry in whatever phase or aspect it may be viewed, either as a promoter of health, or as a potential agency in administering to man's comfort and enjoyment, or when considered only from an aesthetic standpoint, and doubly more so when viewed from an economic or utilitarian standpoint, or as an efficient agent or instrumentality exerting a highly favorable climatic influence.

Thus estimating it, I would, of course, urge the newspaper writer, the essayist, the pamphleteer, the author, the literarian, the belles-lettres scholar, the lyceum lecturer, the

platform orator, the political economist, the common school teacher, the learned instructors of our academies, the scholarly college and university professors, in short, the people's instructors of whatever class or character; all these moulders of public sentiment I would implore to bear in mind the importance and value of *forestry* as a branch of study, and keep it in the foreground, and urge the use of adequate means, efforts and time to the work of popularizing *forestry*, and impress the public mind with a proper estimate of its importance. Especially would I have the pulpit orator make prominent in his teachings the moral aspects of *forestry*. With no less zealous enthusiasm would I have the mass of the people enter into the spirit and observance of *Arbor Day* as a national holiday, incidentally by so doing, promoting the great and growing interests of *forestry*.

Why should not *forestry* be as certainly a branch of study by the American people as botany, chemistry, history, philosophy, geography, zoology, geology, archeology or astronomy? And why should not a taste for the study of *forestry* be cultivated by the present and on-coming generations of American youth?

"So long as the rivers flow,
So long as the mountains rise
May the forests sing to the skies
And shelter the earth below.
Hurrah for the beautiful trees—
Hurrah for the forest grand—
The pride of the centuries,
The garden of God's own hand."

This, by way of conclusion, in the beautiful thoughts of Prof. Venable, and finally in the pertinent truths poetically expressed by the poet Whittier* in harmony with the foregoing:

"The wealth, beauty, fertility and healthfulness of the country largely depend upon the conservation of our forests and the planting of trees."

Yours truly,

ISAAC SMUCKER.

REMARK: Hon. Isaac Smucker is one of the pioneer advocates of forestry in Ohio, and a man of great public spirit.—A. L.

CINCINNATI, O., May 13, 1889.

Adolph Leue, Cincinnati, O.:

DEAR SIR: I received yours of the 12th inst. in regard to endowment of a Chair of Forestry in the university of _____. I think such a movement would be of incalculable good in view of the continued depletion of our forests. Something in the way of systematic scientific efforts should be done at once to repair the waste and not leave it to individual efforts.

Much has already been done in that direction by your society, and especially by our aid, but there should be more means and a contribution by the State to the university should be made for that purpose.

Truly yours,

JOSEPH COX.

*In a letter to Dr. John B. Peaslee.

ANNUAL REPORT

BOTANICAL LABORATORY, CORNELL UNIVERSITY,
ITHACA, N. Y., November 7, 1889.

Prof. Adolph Leu:

DEAR SIR: Accept my thanks for the copies of your reports and the other papers which you were so kind as to send. I have, for the present, a class in arboriculture and forestry which is showing a very marked degree of interest in the subject. Your reports will form a very valuable addition to our literature concerning American Forestry.

The question as to "the necessity of providing for the instruction in the science and practice of forestry" seems to me to be a very important one, and one, nevertheless, which is not so easily answered. What is needed is a better knowledge of the principles of forestry among the people, and a wide-spread conviction that the subject has become one of great national importance. When this stage has been reached we shall then have some system of forestry in this country and a consequent call for educated and practical foresters.

At present, it seems to me that instruction can only be educational in its motive; this is all I attempt here. With this end in view it would seem to me to be in the highest degree desirable that courses of instruction in forestry should be given, at least in all the colleges and institutions founded on the national land grant. This would certainly be a start in the right direction, and might lead to important results at no distant day.

Very truly yours,

ALBERT N. PRENTISS.

In another letter by Prof. A. N. Prentiss, written two days later, he says:

"In my last letter I ought to have added that the subject of forestry, in my opinion, might well be made a part of the regular course of instruction in all our public schools. Not that very extended or scientific instruction should be attempted, but that some of the more salient facts should be lodged in the mind of the pupil. This, in time, I believe would bear fruit in many cases. In this connection I believe that Arbor Day, if properly observed, would be an important factor in the educational process."

LAFAYETTE COLLEGE, EASTON, PA., August 1, 1889.

Prof. A. Leu:

MY DEAR SIR: I think it very important that a course of six lectures, at least, should be given on our forests and their legal maintenance, etc., in every college—large or small—in the United States. Dr. F. B. Hough, as my guest, used to come here and talked to classes in the observatory, etc. Good man. * * * * Our Professor, Thos. C. Porter, lectures on forestry to his classes.

Yours sincerely,

SELDEN J. COFFIN.

Prof. Dr. S. J. Coffin, an intimate friend of the late Dr. Francis Hough (the first forestry agent of the U. S. Department of Agriculture) has given considerable attention to the forestry question of America, and realizes the importance of forestry, though he has not identified himself with the forestry movement.—A. L.

FINDLAY, O., May 21, 1889.

Prof. Adolph Leué:

MY DEAR FRIEND: Yours of recent date received. You ask my views in regard to the necessity and practicability of a school of forestry in Ohio. As to the necessity there is no doubt, as it becomes apparent more and more every year. The great mass of the people look upon forestry in no other way, save an effort to preserve the timber now standing. They have little or no thought about planting new forests. We often hear them say: "I have timber enough while I live." There is no thought of the future.

As to the practicability of getting people interested in such a school, not knowing any thing about your plans, I scarcely know what to say. No doubt you have observed that the persons in Ohio who take an interest in forestry are almost universally people who have passed the middle life.* This industry is too slow for the young American who wants to see money or fame immediately before him.

Will be pleased to hear from you in regard to your plans.

Your friend,

A. P. BYAL.

COMMONWEALTH OF PENNSYLVANIA, EXECUTIVE CHAMBER,
HARRISBURG, September 18, 1889.

Adolph Leué, Secretary, etc., Cincinnati, O.:

MY DEAR SIR: Your letter of the 31st ult. has been received. Pressing engagements which have occupied my entire time since its receipt, have prevented an earlier reply. I am much interested in the subject of forestry. The time has come in this country, it seems to me, when it demands the attention of thoughtful people. Every consideration of self-interest points not only to the study of the subject, but to its every day practice. If our timber supply is to be maintained; if the disastrous floods growing every year more destructive are to be prevented; if our temperature is to be moderated; if our rainfall is to be regulated, and if our waste lands are to be utilized, it seems to me that it is of the first importance that we should teach the principles of forestry in our common schools and insist upon their practice in every-day life. The observance of Arbor Day is pleasant, and in a degree profitable, but it can in no sense supply the place of practical and scientific instruction upon the whole subject of forestry. *I sincerely hope that you may be able to secure legislation in Ohio that will promote both the study and the practice of forestry.*

Whether its importance is not realized, or whether it arises from the fact of our legislators being unwilling to take hold of what seems to them new, I can not say, but certain it is that we are allowing valuable time to pass, when we should be providing for such legislation as would encourage our people in reforesting our hills and much of our so-called waste land. We will have a rude awakening some day and find that the waste of the past and present generation can not be repaired in time to serve the needs of those who are comming immediately after us.

Very cordially yours,

JAMES A. BEAVER.

REMARK.—Governor James A. Beaver is one of the most active advocates of forestry. At the meeting of the American Forestry Congress held in Atlanta, Ga., 1888, he was unanimously elected President of that body,

*Hon. A. P. Byal, who was Chairman of the Committee on Agriculture, House of Representatives (1885), to whom the bill creating this Bureau was referred, is not aware that of late years Forestry Clubs, consisting of young people exclusively, have been organized, and that make great efforts to inform themselves in matters pertaining to forestry. The Woodward Forestry Club of Cincinnati is fair example of such organizations.—A. L.

and re-elected to that office at the meeting held in Philadelphia, Pa., October 16, 17 and 18, 1889.—A. L.

COOLVILLE, O., August 22, 1889.

Adolph Leué, Esq., Cincinnati, O.:

MY DEAR SIR: Your letter in regard to the question of education, etc., in the matter of the science and protection of forestry, is received. I can scarcely give you any valuable suggestion in regard to the necessary education in this direction; I can only say to you that I deem the subject of the promotion of our forestry interest a subject of very great importance to the people of the country, and I think that both the Government energy and private enterprise should be directed to the study of the scientific question involved, and to the promotion of all efforts in the direction of securing the present supply and largely increasing the compose upon which the forests of the country may grow; not only does the scientific condition of the country and its protective interest demand this, but the usefulness of temperature in the future will be affected seriously by the continued neglect of the protection of new forests.

Yours truly,

C. H. GROSVENOR.

The following appeared in the *Cincinnati Commercial-Gazette* of March 7, 1890:

CIRCLEVILLE, O., March 3, 1890.

Editor Cincinnati Commercial-Gazette:

DEAR SIR: The wisdom of establishing Schools of Forestry is too manifest to demand repeated citations. Still it is necessary to do so. Such schools are things of necessity in all civilized countries; and it is as useless to attempt an indifference to the subject as it is to blind our eyes to the contingent magnificence and power and glory that awaits our great State in time to come. We have but to preserve and utilize the good things nature has bestowed on her, and our flocks and herds and fields of corn will remain forever the wonder and admiration of the world. Fertility of soil, watered by heavenly showers, can soon be made a barren waste, through ignorance and legislative indifference to the laws which govern the productiveness of a country. And need we wait until too late? Need we be in the rear of less important States? Every one who has given the subject the least attention says: No, no, go to the front, establish a School of Forestry now, make ample appropriations for that purpose, and coming generations will bless those who have taken the first and most difficult of all steps in the right direction. No legislative enactment would be of so much importance to the welfare of the State as this; and surely none would meet with more universal approval.

Hoping the intelligent press of the State will urge the present Legislature to take favorable action for the establishment of this character, we remain,

Yours truly,

N. E. JONES, M. D.

EFFORTS FOR THE ADVANCEMENT OF FORESTAL EDUCATION IN THE STATE OF NEW YORK.

A very strong effort to establish a School of Forestry by the New York Academy of Sciences in conjunction with the New York State Forestry Association has been made. The prime mover is Dr. H. Nicholas Jarchow, of New York City, who, early in December, 1888, brought the subject to the attention of the Academy of Sciences, of which the *New York Independent* of December 13, 1888, had the following graphic account:

SCHOOLS OF FORESTRY.

[BY D. D. T. MOORE.]

The New York Academy of Sciences at its regular meeting, last week, had a very interesting and instructive session, mainly devoted to an address on Schools of Forestry and a discussion of the subject, including remarks on the necessity and manner of preserving the woodlands of the State of New York. The discussion was opened by Dr. H. Nicholas Jarchow, formerly editor of the *Farmer's Zeitung* and lately connected with the *American Agriculturist*, who has had experience in forestry management both in Germany and this country, and is now preparing a work on "Forest Planting," with especial reference to restocking denuded woodlands and waste lands on plains and mountains.

Dr. Jarchow's address on Schools of Forestry alluded to the training of foresters in Europe and the economic success that has been attained there in forest culture. In opening he said the forests of our State are in a bad condition, as all conceded; but they are not by far in such a miserable state as were the forests of Germany 150 years ago, when they were devastated by continued warfare, thus depriving the owners of large forests (Government and corporations) from deriving adequate income therefrom. In order to remedy this evil many scientific men devoted themselves to the exclusive study of forest treatment, and perceiving the necessity of intrusting the management of forests to a specially educated and trained body of officials, gathered around them (as in ancient times did the teachers of philosophy) young, enthusiastic men, and imparted to them the requisite knowledge—such as they had acquired by years of study and observation. The most successful teacher in this line was the Overforest-master Von Langen at Brunswick, he being the chief officer over the forests in that Dukedom—a little territory of about one and a half million of acres, one-third of which consisted mostly in mountains formerly covered with dense forests, but then nearly denuded. As the income of the Duke was largely derived from this region, called the Harz, Von Langen devised a plan by which care was taken to always have a sustained growth of wood and a natural restoration of the forests.

This man, who is justly considered as the principal founder of the present scientific system of forest management, had always young men for his assistants, to whom he imparted theoretical and practical instruction; and from a body of such men he established the first school of forestry in 1772. At this school arrangements were made for forestal experimental research, and everything was done to retrace the practical results to their scientific basis. For this reason the advanced economy of to-day is rightly called Scientific Forestry; and this means, first, to continually have a sustained forestal production from a certain area; second, the natural regeneration of these forests; and third, a progressive improvement of the forest in place of former deterioration.

You may say: "This is all very well, but how about the expense? Does it pay to thus expensively manage forests, even on the poor soil of the mountains?" This question can undoubtedly be answered affirmatively, provided the management is placed in the hands of experts and not given to mere politicians. The doctor had recently seen an official publication issued every year by the German Government in regard to the average production of wood in the State forest, and the revenues derived therefrom. These documents are very instructive and greatly encourage the introduction of scientific forest culture on the estates of corporations and individuals in that country. From an issue of this kind for 1856 it appeared that the management of 250,000 acres of Government forests of the above cited little Dukedom of Brunswick, caused an expense of \$278,000, or about \$1 per acre, and that the income of that year was \$635,000 or about \$2.25 per acre. The net proceeds of an acre of woodland was, therefore, about \$1.25. Very interesting is a volume of the same work, issued thirty years later in 1886. From it we see that, after deducting the expenses, about \$2 per acre, the income of the forests—not only in Brunswick but in all other parts of Germany—have increased to over \$2 per acre by this management. If you consider that in the densely populated old country only such soil is allowed to be kept in wood as is unfit for culture, you will concede that, leaving out of the question the beneficial climatic influences and other economical advantages which are due to the forest, \$2 per acre is a pretty good profit.

How does this compare with our 850,000 acres of woodland owned by the State of New York? In fact, the State has had, up to this date, not only no income from its woodlands, but has had to pay a handsome sum annually for the honor of being possessor of such extensive forests. The blame for this state of affairs does not fall upon the legislature of our State, for Section 18 of the Act passed May 15, 1885, contains this provision:

"The Forest Commission shall take such measures as the Department of Public Instruction, the Regents of the University and the Forest Commission, may approve for awakening an interest in behalf of forestry in the public schools, academies and colleges of the State, and of imparting some degree of elementary instruction upon this subject therein."

Dr. Jarchow thought that, were this provision carried out, the Empire State would inaugurate a new era in political economy, and lay the foundation upon which to build the science of systematic forest culture, as it must give rise to forest schools. And experience teaches us that in all countries where profitable and systematic management of the forests has been successfully introduced, the first step to it was the establishment of schools of forestry; for men educated in such schools become not only fitted for their vocation, but consider their position as a trust. In discharging their duty to the Government, they are not only stimulated by fealty to public authority, but by a professional sense, which makes dear to them the forests given to their care and protection. From unskilled laborers you can not expect such devotion to the interests of the position as is developed in a trained forester; that man will always do his full duty, even at the peril of his own life.

"Whether our public schools will be the proper places for awakening interest in behalf of forestry, we will omit from this discussion," continued the speaker; "but our academies and colleges should consider it their duty to impart not only elementary but full scientific information upon the subject. In Europe colleges of forestry and agriculture are mostly combined, and require two years of study to complete the forestry courses alone. During the winter months instruction is given in several branches of forest science, while the summer months, after deducting some weeks for vacation, are employed in making excursions to places where forest operations are going on, or where the students have an opportunity to practice what they have learned during the winter. But at present it would be of far greater advantage to our State to establish a simple 'School of Forestry,' in which young men could receive the proper training for rendering them qualified for appointment to subordinate positions in the forest service. France to educate good foresters by purchasing the well-known forest farm

'Barres,' which belonged to M. Vilmorin, and had been used for fifty years as a private experimental station for forest trees."

To establish such a school in or near the Adirondacks, Dr. Jarchow declared would be a move in the right direction for bringing into effect the well-meant provision of the quoted Section 18 of the Forestry Act. It is true the report of the Forestry Division of the Agricultural Department at Washington, for 1884, very strongly recommends the establishment of schools of forestry by the Federal Government; but to wait for this sensible advice to be acted upon would show too much faith in the activity of Congress regarding matters other than those merely political. It is the duty of each State in the Union to take care of its forestal interests and to educate its own officers, especially as diversity of climate, situation and other economic reasons will make the proper training of the foresters in the various States in certain respects a diversified one.

As for the cost of establishing and maintaining such an institution, the Doctor thought it would not be very large, especially if adjoining States of similar climate and topography would unite and contribute in proportion to its support. Indeed, the labor performed by the students upon the grounds of the institution would make it nearly self-supporting, and the demand for trained foresters in the United States would bring more pupils than could be accommodated. But the benefit which our commonwealth would derive from the introduction of a systematic treatment of the State forests, would be so great as to make it nearly impossible to now give even an approximate estimate of its value. Besides a considerable income to the State, the army of men who are now used by unscrupulous lumbermen and their agents in illegally felling timber on the State's domain, and who are becoming more depraved every year on account of the non-punishment of their continuous plundering, could then be easily made to return to an honest and well-paid industry, as a great number of laborers would be required to bring the forests into such a shape as to secure a sustained forestal growth—a natural regeneration of the trees, and a continually improving condition of the forests.

The discussion which followed was participated in by Prof. O. P. Hubbard, who presided, Daniel S. Martin, the Rev. Dr. J. C. Spencer, Cornelius Van Brunt, and other able scientists. The speakers strongly favored the furtherance of scientific forestry by means of training schools and otherwise. Mr. Martin suggested that Cornell University was the best fitted of any of the educational institutions of the State to take up the work, adding that one of the objects of its founder was to furnish instruction on any special subject whenever should arise a public necessity therefor.

This action by our Academy of Sciences on the important subject of forestry, and training schools for its promotion, is very timely and can not fail of exerting a salutary influence. Just now the subject is receiving marked and merited attention, the able and instructive discussions of the National Forestry Congress (held at Atlanta, Ga., last week), having given it a great impetus throughout the country.

Under the heading of "THE STATE FOREST PRESERVE," Dr. Jarchow wrote in the New York Times, March 23, 1890, after having exposed the inefficiency of the New York State Forestry Commission, the following:

"On a proper place within the preserve* there should be set apart a denuded tract of about one thousand acres, with good forest soil, for establishing a nursery where seeds of native forest trees could be collected, and the seedlings required for the re-forestation, of the stripped woodlands, be raised. As there is no doubt that very soon a more skilled treatment of both private and public forests will be necessary, it would be an act of good statesmanship to select a place which could serve not only as a *forest school* for training skilled foresters, but also as a *forestal experiment station*. In other words, the plan for

* Reference is made to the Adirondacks Forest Preserve.—[A. L.]

this institute should be laid out so as later on to combine with the practical purposes educational and scientific aims for the culture of progressive forestry. For this reason it should be kept out of any political dealings, and placed under a board consisting, say, of

- (1.) President of the Forest Commission,
- (2.) President of Cornell University,
- (3.) President of Columbia College;

or of some such combination, both practical and scientific men. This board would have to formulate rules and regulations, and select a superintendent, who should possess besides a good education, sufficient knowledge of forest culture."

Dr. Jarchow estimates the cost at \$30,000 for the first three years, in which, however, he does not include the establishment of the forest school. Correspondence with friends of forestry in New York State, indicates that a very strong effort will be made at the next legislative session of that State, to secure the establishment of a school of forestry.

THE NECESSITY OF FORESTS AND FORESTRY.

[By ADOLPH LEUE.]

Motto: No culture without forests;
No forests without culture.

1. ART AND INDUSTRY THE TRUE INDEX OF A NATION'S CULTURE.

A nation's standing in culture is not to be measured by the attainments of a few individuals in the various branches of art and industry, nor by the development of one or a few special branches, but by the general attainments in and by the development of all the leading arts and industries.

Greece and Rome were at the very height of culture, when art and industry flourished among them. With the decline of their industries, which was contemporary with the decline of their forests, those nations gradually lost their individuality and sank back into a state of semi-barbarism, from which they never recovered.

As far as the development of arts and industries among European nations of the present day is concerned, the Turks probably rank the lowest. Of them Dr. Schliemann, of antiquarian fame, writes from Salonica: "As a fellow Unitarian I feel sorry for the Turks, but as a respecter of God's physical laws I must own that they deserve their fate."

Men, who for more than twenty generations have proved themselves tree-destroyers on principle, have no right to complain when the world rises against them." The lamentable condition of the forests of Turkey is almost proverbial. Scanty, and stocked with an inferior kind of trees, they furnish not only a limited quantity, but also a poor quality of forest products. It is, therefore, not at all surprising to find that arts and industries do not flourish there. The people have become indolent and consequently poor. Their existence as a nation is but a question of time.

If we measure our attainments in general culture by the same standard—the development of art and industry—we shall find that our standing compares favorably with that of any nation on this globe. Such a development, however, would have been impossible had our forestal relation been less favorable. The bounteous supply of our forest products and their superior quality are, without the least doubt, the foundation upon which the development of our industries rests. If, at any time, this supply of forest products should give out, the industries depending upon this supply must necessarily decline.

Manufacturers of wooden products are becoming alarmed about the growing scarcity of various kinds of timber. To-day our carriage builders, cabinet-makers, and the followers of other wood-working industries are looking with serious apprehension to the time when this unhappy catastrophe shall be upon us.

In view of the fact, that in the more densely populated portions of our country, and in the districts adjoining such portions, all the more valuable trees have been cut, so that the manufacturers must import from great distances, or be satisfied with an inferior kind—and that practically nothing has been done to provide for the planting of new forests, it is, indeed, not difficult to understand that there is cause for such serious apprehension.

2. THE NATURAL RE-JUVENESCENCE OF FORESTS IS INSUFFICIENT.

We are told that nature, if left alone, will do the work of reforesting without the interference of man, and so she will, but let it be remembered that nature will do this in her own way and time, and in doing this will take no cognizance of the wants of our industries. Nature may—as she indeed does—often grow trees of no special value—and these are generally the most prolific—on lands capable of producing the more valuable kinds. In the forests of the future no tree of *an inferior or no commercial value* unless it be used as "nurse-trees," should be or will be tolerated. The number of species of trees which will enter into the forest of a given region will be small as compared with the number of species indigenous to such region. These, as a matter of course, should be carefully selected.

The number of species which will enter into the forests of Ohio will probably be limited to sixteen, or 13 per cent. of all the forest trees indigenous or acclimated in this State.

About forty or fifty of all the various trees of the State will be utilized by the landscape gardener, who will plant them for shade and ornament. Friends of Nature and botanists need, however, not be alarmed, fearing that they might become extinct, for institutions of learning are beginning to establish arboreta, which will contain all of our native trees and such other foreign species as will grow in our soil and climate. Besides these institutions there are botanical and zoological gardens where they will be grown. There will, however, always be neglected spots, where they will spring up from seeds carried thither by animals or by the wind.

Nature in her work of reforesting does not make such discrimination. Hence we find in our natural woods all kinds of trees, "good, bad and indifferent," the less valuable often out-numbering the more valuable ones.

3. NO FORESTS WITHOUT CULTURE.

Experience as well as common sense teaches us, that the selecting of the species and the mere planting of the same is not a guarantee of successful forestry.

In this country we have heretofore not made any distinction between forests and woodlands, while in Europe, and more especially in those countries in which forestry has reached a high state of development, the distinction is clearly defined. Prof. Rossmässler, in speaking of the difference between forest and woodland (*Forst und Wald*), says*: "Every forest is also a woodland, but not every woodland, be it ever so large, is a forest. It is the regular cultivation and economical management which turns a woodland into a forest."

This difference between forests and woodland is also indicated by the terms *forester* and *woodman*; the former term being applied to the man who advocates the perpetuation of woodland in accordance with the principles and teachings of forestry, and the latter to the man whose profession is that of felling trees.

In this meaning of the term, we, in this country, have really no forests, but woodlands only. To turn these woodlands into forests, and to plant forests, where for climatic and other considerations they are needed, is the aim and object of the advocates of forestry.

The forester, it will be seen, has a distinct mission, which is *to perpetuate the forests so indispensable in civilized life, and to produce at a minimum expense, from a given piece of ground, the greatest amount of forest products.*

**Der Wald*, von E. A. Rossmässler (Leipzig and Heidelberg, 1863), p. 4.

As our forests decrease in extent and deteriorate in quality, and as, with the increase of our population, the demands upon forest products of all kinds become greater, the necessity of a rational system of forestry, and the need of educated foresters becomes more apparent every day. We should, moreover, constantly bear in mind that, while there are trees as the catalpha, the ash and the hickory, which will attain merchantable size in *forty* or *fifty* years from the seed, there are others, such as the pine and the tulip-poplar, which require for reaching the necessary dimensions a period of from *sixty* to *eighty* years; and still others, such as the oaks and the black walnut, for the full development of which about 150 years are required. Can we, in view of this, still be in doubt as to whether or not the time has come when we should earnestly consider the question?

SHALL WE OR SHALL WE NOT COMMENCE THE PLANTING OF TREES TO
PROVIDE FOR FUTURE WANTS?

Again, we should remember that with the increase of population, all the land which is available for agricultural purposes, will be needed for the production of the ordinary farm crops, and the forester will have to limit his operations on sandy wastes, hillsides, mountains, slopes and stony fields.

In consideration of the fact that the amateur foresters encounter great difficulties in the attempt to raise trees under the most favorable circumstances, as far as soil is concerned, it certainly must fill our minds with serious apprehension when we come to contemplate upon the probable results of the attempts to raise forests on soil and in situations with altogether unfavorable conditions.

In agriculture, a mistake in the choice of crops or in the methods of planting and cultivating is a loss, yet the mistake may be corrected or avoided in the year following, and sometimes even in the same season.

In practical forestry on the other hand, a mistake of this kind may not become apparent for several years—sometimes not in a generation; for it is a fact, that a plantation may present a very prosperous appearance for ten, twenty, or even more years, before the first signs of a mistake show themselves. The whole plantation, after the elapse of such time, assumes a sickly appearance, struggles, may be, for a few years, and then begins to decay rapidly.

What is the cause of this failure? Was there a mistake in the choice of the crop, or was there an error in the cultivation? Be that as it may, the fact remains that the plantation was a failure.

To prevent such failures in agriculture, the national government, wisely and with great munificence, provided *schools of agriculture* and *agricultural experiment stations*.

In view of the fact that the difficulties in forestry are far greater than they are in agriculture, it is astounding that for forestry nothing has been done in this direction.

Years ago, when our forests fairly seemed to be inexhaustible, when we had more forests than were consistent with health, or were needed for climatic considerations, when the supply of forest products was far in excess of the demand, there was, indeed, no need of instruction in forestry. But to-day when the forest area of the State has, within a century, been reduced from about ninety-nine per cent. to fifteen per cent. of its superficial area, and when of these fifteen per cent.:

29 per cent. are heavily wooded.

29 " fairly heavily.

And 42 per cent. are sparsely wooded.

And then call to mind that the greatest number of trees growing on this area are of an inferior value, the best having been removed, it is indeed impossible for us to entertain any doubts as to whether or not we should begin to take such steps as may be necessary to effect a reform in the modes of treating our woodlands.

To institute a successful forest culture, we must provide means for educating and training forest culturists or foresters.

From what has been said, it will be seen:

1. That culture is a blessing.
2. That a nation's culture may be determined by its attainments in art and industry.
3. That arts and industries are dependent upon a generous supply of forest products.
4. That the constantly increasing demands upon forest products have, in Ohio, as well as in other parts of the country, diminished the forest area to an alarming extent.
5. That the natural rejuvenescence of forests is inadequate to perpetuate the supply of forest products.
6. That to perpetuate the forests, there is a great need of forest culture.
7. That forest culture is a profession far more difficult than agriculture.
8. That to assure success in forest culture, we need men educated and trained in all the branches of forestry.
9. That the establishment of an institution in which to educate and train foresters is an absolute necessity.

If we therefore wish to perpetuate to our children the blessings of culture, we must perpetuate our forests by forest culture, for which a corps of well-trained foresters will be needed. To obtain these we must provide for their instruction and training.

THE BEECH TREE BLIGHT.

PEMPHIGUS IMBRICATOR.

Among the diseases of forest trees the *Beech Tree Blight* is not uncommon in Ohio. In reference to this disease the following communication from Dr. J. A. Lintner, State entomologist, of New York, to the Elmira Husbandman, (Nov. 1886), will be of interest:

I have received from Dr. Sturtevant, of the New York Agricultural Experiment Station, a communication addressed to him from Mr. James S. Whitaker, of Penn Yan, N. Y., containing specimens on the under surface of a leaf of an insect about one-sixteenth of an inch long, with a tuft-like down attached to the end of its body. It is found in large numbers in the woods, but only on the beech. The limbs are so thickly covered with them that in their continual swaying motions back and forth they all keep time. Underneath, the leaf and ground are covered with a blue or drab-colored substance, undoubtedly the offal from them. The request is made that some note of them, their peculiarities, and possible harm be communicated to the Husbandman.

The insect is one of the Aphides (*Aphididae*) commonly known as plant-lice, having the scientific appellation of *Pemphigus imbricator*. Popularly it is known as the beech tree blight.

It was first described by Dr. Fitch, in 1851, in the fourth annual report of the New York State Cabinet of Natural History, and as that publication is almost inaccessible, the description is herewith transcribed:

"*Eriosoma imbricator*, black; three last segments of the abdomen blue-pruinose; stigma brown; longitudinal nerve and a line on the middle of the inner margin black. Female (?) winged; abdomen fulvous, with a black spot on the disk; legs pallid, larva pallid, with two fuscous dorsal stripes; posterior half of the abdomen covered with a tuft of cotton-like down, from which proceed two longer and coarser filaments. Length, 0.22 inch. On the under side of the branches of the beech tree, covered with snow-white down. On the slightest jar of the branch, a shower of tiny drops of a water-like fluid falls from these insects."

This species has been noticed by but few of our writers. Dr. Thomas, in the Eighth Report of the Insects of Illinois (p. 139), refers to it, quoting from Dr. Fitch, and assigns its place in the genus *Schizoneura*, where it does not belong, as its third discal vein is not forked. Dr. Packard, in his "Insects Injurious to Forest and Shade Trees" (p. 131), cites it among beech insects, also designating it as a *Schizoneura*.

A peculiar feature of this insect and of its allied species, which so often draws attention to them, is the white substance in which they are enveloped, resembling threads of cotton or wool, and which has given to them the name of "woolly aphides." It appears in the form of threads or fibres which are sometimes long and flattened as in the beech blight, and sometimes in the form of a fine powder. The substance is secreted by glandular organs in the abdomen and thorax, and is of a peculiar character, being insoluble in water, alcohol or solution of potash, and is not melted by the application of heat. The purpose which it serves in the economy of the insect is not known.

The allied species of woolly aphides above referred to, are those of the apple (*Schizoneura lanigera*), of the elm (*S. rileyi*), of the oak (*S. querci*), of the pine (*S. strobi*), of the

hickory (*S. caryæ*), of the alder (*Pemphigus tessellata*),* and a few other less frequently met with. Of these, the last named species is quite common, and often occurs in great abundance, completely enveloping in its white coating, the branches of the alder.

The "blue or drab colored substance upon the leaves and ground" underneath the insects, is the powdery secretion that enveloped the various sized globules of excreta given out from the anal extremity of the aphis, which fall to the ground "in a shower of tiny drops on the slightest jar of the branch." Numbers of these little meal-coated globules may be seen within the galls of some of the gall-making *Pemphiginae*, the coating of which prevents the fluid from attaching itself to the plant-lice that move about freely among them.

A large portion of the white substance fastened to the under surface of the beech leaf received, consisted of the cast skins (*exuvia*) of the plant-lice at their different moultings, packed upon one another in a half-dozen or more layers.

Of course, all the aphides are injurious to the vegetation that they attack—the amount of their harm depending upon their numbers, and the quantity of the sap that, by means of their beaks inserted into the bark, they are able to withdraw from the circulation.

As the peculiar coating of these woolly aphides protects them from most of the insecticides that could be applied to them in a liquid form—shedding the fluid without absorption—the best remedy for them to be found is crushing them with a cloth, stiff brush or broom, as they occur in their conspicuous masses upon the trunks and branches.

THE NEW METHOD OF PLANTING IN THE FORESTS.

BY FORESTMASTER MORITZ KOZESNIK, OF SAYBUSCH, GALICIA.

(Translated by Mrs. Conradine Adolph Leue, Cincinnati, Ohio.)

Each slight change of color,
Each growing and blooming,
Each withering and dying—
Observe with constant delight.

—After Em. Geibel.

"One glance into the book
And two—into Nature."

—Pfeil.

Climatic influences and their physiological consequences were the chief factors that led, in recent time—wheresoever artificial forest-culture exists—to the cause, that the greatest part of the whole area and frequently the whole tract, was given over to the planting, while the seed growing was limited to a very small per cent., sometimes even reduced to

* This insect was found on almost every European alder in Dr. J. A. Warder's experimental plantation at North Bend, O., in September, 1873.—A. L.

the growing in the nursery, unless a special aim would cause the seed-growing on a large scale in the open forest.

The method of planting, which is mostly used in practice, is the so-called "pit-planting, with the assistance of the pit-ax;" only occasionally one of the other methods is chosen, which answers better under certain circumstances.

The future of the artificial forests depends mainly upon the manner of planting and reasoning—according to the former statement—upon the manner of the "pit-planting, with the assistance of the pit-ax."

Now, what is the direction to carry out this most applied method?

Here the peculiarity shows itself: a clear, precise direction; such a one as exists for the methods of "Bierman, Butlar, Manteuffel, and others," does not exist for the method of the "pit-planting, with the assistance of the pit-ax." It is just this: this oldest method of planting, which has undergone such manifold alterations, but not always to its improvement.

In the present abundance of the excellent works on forest-culture we find the "pit planting, with the assistance of the pit-ax," in many variations, and in an otherwise prominent work it is even recommended "that finally the soil should be firmly treaded down." The preliminary in the practice is accordingly of a corresponding difference, but of not less difference, is also the result.

In the most recent and modern times it has been stated repeatedly that greater areas—I know of forests comprising hundreds of hectares,* which are over fifty years old, where it could be proven that they carried already the germ of disease all along, from the commencement of culture, as the result of an irrational treatment, either before or after planting—and that, on this account, they had to be cut down before maturity.

"Not the years alone,
The sufferings also help to determine
The age!"

It is also asserted that the damages which occurred by fungi and insects were also the consequences of the above cause; also, that even a continuous drouth could not bring on the death of the plant. Proof: Because, since, as a rule, entire lots of small trees, rationally treated, were well preserved, while others, planted near them, of which a close investigation in particular cases, showed clearly that they had been unrationally treated, either before or during the planting, had succumbed to the drouth, etc. Indeed, the time has come that this defect, which results in such

* A French measure containing 100 acres.

disastrous consequences, should be remedied, and when I venture to come forward with the method of planting introduced by me, I am encouraged.

1. By the uncommon favorable results which were put forward, especially in a series of dry years.

2. The full conviction that, by a close adherence to my direction, a germ of disease, caused by injuries in planting, is forever wholly excluded.

The direction to carry out my method of planting is :

PRIOR CONDITIONS.

I. The plant should be taken out at the proper time with a spade, and under no circumstances with another instrument; if possible it should be done in cloudy weather, and where this is impossible, either before or after sunset; great attention should be given to the roots; the plants should be lifted out of the ground with great precaution, so that the extreme points of the roots will not be injured, and carefully covered as soon as they are laid on the ground.

II. The plant thus carefully taken up should also be protected during the transportation and until the planting commences, so that the tiny rootlets and especially the points of these rootlets do not wilt.

I mention here these known precautions because they are of paramount importance, and I am compelled to make the result of the planting, to a considerable degree, dependent on these so often neglected measures.

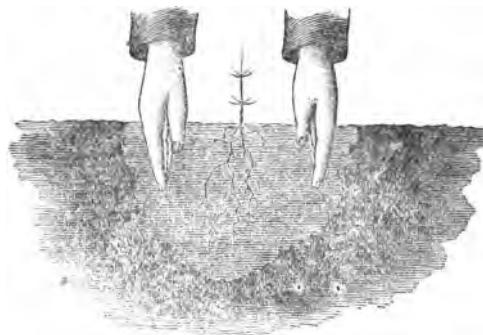
The planting itself is to be carried out as follows:

“The soil shall be loose
In which the little plant takes root—
And if you do not plant it in real good,
No tree will bear you—any fruit.”

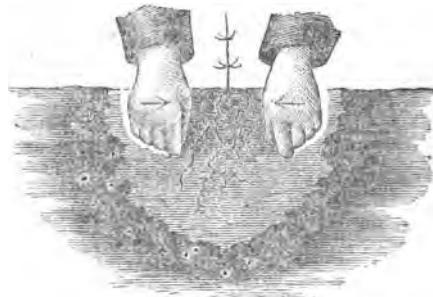
1. The pit or planthole is to be made with the pit-ax a little deeper than the root is long.

2. No dirt should as yet be strewn at the bottom of the pit. The planter takes hold of the plant with his left hand above the knots of the roots and lowers it down to the bottom of the pit. While he, with his right hand, now strews the dirt around it, with his left he should raise it gradually until the root-knot is nearly parallel with the surface of the ground

3. Now both hands should simultaneously be stuck into the ground as shown in Figure I, about two inches distant from the little plant, for the purpose of getting on both sides equal space and by the motion of both hands from one side to the other the spaces will be enlarged.

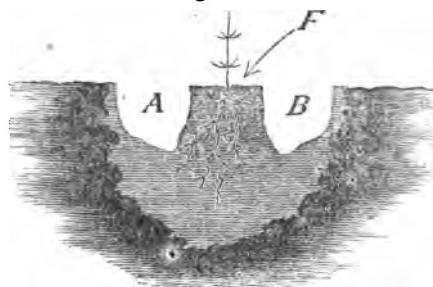
Fig. I.

4. In these two spaces turning movements should be made, as shown in Figure II, and the earth should then be pressed with closed fists,

Fig. II.

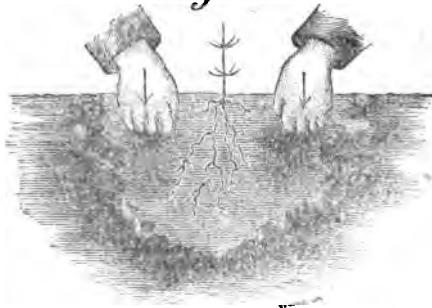
horizontal, on both sides simultaneously, against the roots of the plant. During this horizontal pressure the plant can—if yet necessary—easily be put upright.

5. The plant is now standing in the spot F, Figure III; there remain

Fig. III.

the empty spaces A and B; these have to be filled up with soil, and this filling should be pressed vertically downward close to the spot F, with closed fists as shown in Figure IV.

Fig. IV.



This vertical pressure should, however, not come too close to the spot F, in order that the spot F by the interposition of the soil be pressed sideways and not downwards.

6. Through this vertical pressure there remain two inconsiderable deepenings which must be filled up with loose soil, as also in general some loose earth should be scattered around the plant.

Whether or not it is necessary to mix the earth with rich soil is to be determined by the local condition.

Plants two to three years old are the most suitable for this method of planting. By the transplanting of young trees, or larger plants, I always endeavor to treat all the small capillary-roots of the larger main roots as a single whole one. Planters properly drilled soon acquire skill in this mode of planting which, in reality, is very simple and can be performed in a very short time. The aim of this method of planting, as will readily be seen from the preceding statement, is: *to protect the plant against every barbaric treatment; to convey to the system of roots a spirited current of air and to give access to warmth and precipitations; to give the plants on their entering into isolation a good amount of crumbled earth, and to give them, notwithstanding the loose condition of the ground, a firm foothold!* Trees planted according to this method will also thrive in time of drouth because this method favors the entering of dew.

It sometimes happens that this precipitation also ceases! This is certainly an extremely bad time for the cultivation, and the drying off soon commences, at first at the points of the capillary roots of the upper root-system, and so gradually downward.

Here lies also an advantage of the described method, for plants which are planted accordingly are able to preserve themselves for a certain length

of time by means of the vertical and deep lying series of roots as long as the drying up has not entered the lower stratum.

But how often has not even a short cessation of the precipitation of dew been decisive for the preservation of the young plantation! I am very well acquainted with the objection to which my method of planting is exposed. Arboriculturists are generally, and to a certain degree justly, of the opinion that the roots should, as much as possible, remain in the upper warm stratum of the ground. Well, by this method, some of these roots do remain in the upper stratum, and by following the given instruction of treatment, the points of the roots, even also of relative kinds of woods, the capillary roots are well preserved. The more natural position given in this way to the system of roots facilitates, in a great measure, the development of the points of lateral roots in a free horizontal direction, and the loose condition of the ground favors to a great extent the development of the new runners as well as the access of a spirited change of air, dew* and warmth. By entering into isolation, the nourishing action is excited in an extraordinary manner, and as this process takes place especially in the upper warmer stratum, new rootlets soon appear, especially in the upper part of the ground, extending in a horizontal and an upward direction, while the vertical extended, deep-lying series of roots cross the loose ground chiefly in a horizontal direction by the development of the side rootlets.

A pretext was once made that this (conceded) rapid increase of the roots of the upper series quander (!?) "a certain amount of strength," or more correctly "a certain amount of nourishment." This view I must oppose in every respect. I support my opinion on practice itself, and a look into the physiology of plants teaches us that: "as soon as an organism of cells, by surrounding influences, is stirred up to a multiplication of such substances as may be favorable to its action of nourishment, the transaction of reception and rejection must invariably close with a plus." A contrast to this would be when, for example, the root portion of a plant would be put into a tough loam-mire, and this would, after a while, form a hard crust around the sucking-roots for which, especially in spring, only a little sun or a mild current of air will be necessary, so that the points of the roots were not able to penetrate and would break off, the stem be strong enough to produce new points and those notwithstanding might effectuate to break through. In this case we might be compelled to show a so-called "squandering of strength," or more correctly a loss in the nourishing action.

I will only make brief mention of the time of planting.

All the described advantages appear more especially in spring, next in the height of summer whenever the ground is sufficiently fresh and the

*We will not take into consideration the dewless time.

plants, before they attain their fixed position, and especially on sunny days, are very carefully protected. It might often be necessary to do some supplementary planting in autumn, but there is no assurance that the plants will thrive.

Up to the present there have been planted after my method, 1,800 hectares (180,000 acres) on the estates of His Imperial Highness, the Archduke Albrecht.

The most surprising result which I must ascribe solely to this method, I experienced in the year 1886, and more especially in the archducal estate-administration K——, district B——, pine-plantation carried out in spring, mixed with fir and beech, and occasionally maples.

The district ascends to a height of 3,500 feet, leaning towards southeast; good forest soil, somewhat stony.

The precipitation* in Saybusch and the surrounding country were, since the winter of 1886, very insignificant, falling for that year 2.70 millimeters† short of the average of fifteen years. In addition to this, we have to record an abnormal heat. In the month of May the thermometer rose several times up to 29 to 30 Celsius = 84 to 86° Fahrenheit in the shade.

The greatest portion of the mentioned district was planted during the first ten days of April, after which it did not rain for over three consecutive weeks.

Immediately after the quick disappearance of the snow,‡ which fell at the beginning of May, the planting, on account of a certain haste, continued, in spite of a painful drouth, which lasted for four more weeks.

The high summer brought us a very welcome visitor, and I had the pleasure to accompany him in several districts. Then we came on our way also to the plantation B——, of 1886, of the archducal estate, administration K——. I had not been in this part of the plantation since the planting in spring; it is true, I received, repeatedly, reports about the "good standing" of the plantation, but I do confess I was very much surprised when we went along the whole tract, and then in zigzag down to the bottom of the valley, and were not able to find even one single dry plant. Mr. v. V. U—— soon after wrote me: I still see the triumphant look of Mr. H——, when we could not find even one single dry plant among the whole lot.

I was not so lucky in another planting, carried out in the same year on the same estate, with plants which were taken out with an auger, so-called "clodplants;" though this plantation was made at the time when the soil was in its first freshness and the district had, besides the other-

*January, 59; February, 31; March, 287; April, 155.

†A French measure containing the thousandth part of a meter equal to .03937 of an inch.

‡ May: 54₄ millimeter.

wise similar conditions, the favorable northeastern descend. The continuous drouth caused a severe drying up of the dirt lumps, the precipitations of dew could not enter them, and here we had to record a loss of sixteen per cent. In reference to both plantations, I had to acknowledge to the respective officers the careful and diligent execution of the work, and the respective readers of these lines will, as I do, attribute one part of the particular result in the estate, administration B——, to the credit of the method itself.

I close this treatise with the conviction that the application of my method of planting will also show elsewhere good results—not only on tracts which are suitable to the pit-planting, with the assistance of the pit-ax, but also there where the ground is very stony, and the planting can not take place without soil being added. And through the forest goes a low murmuring:

“The knowledge alone will not succeed
Where love is not its ally.”

SAYBUSCH, May, 1888.

MORITZ KOZESNIK,

Forestmaster of His Imperial Highness, the gracious Archduke Albrecht.

GENERAL OBSERVATIONS ON FOREST ZOOLOGY.

[BY ADOLPH LEUE.]

Forest zoology, or that branch of forest science which treats of the natural history of animals, which are either injurious or beneficial to forests and forest trees, has a just claim upon the attention of foresters and orchardists. It is only a few years since the importance of this study was recognized by the friends and advocates of forestry. As long as the country abounded in forests and cleared land was the great necessity, every agency to aid in the work of forest destruction was welcome; but now, since the forests have been removed far beyond a wholesome extent, and attempts are made to raise so-called *artificial* forests, which fall a victim to insect depredation, our attention is very forcibly called to this subject. A detailed account of destruction by locust borers has been given in the Third Annual Report of this Bureau, pp. 12-22. This destruction of the black locusts, whether in groves, or along the road sides or along fences, or whether standing singly in parks or commons, is not

confined to a few localities but is co-extensive with the distribution of the tree. Up to date no practical means to successfully combat these insects have been found. Devastations by insects, though not so extensive, are noticed among maples, oaks, hickory, elms, and several other trees. All known artificial means to extirpate these depredators are either too expensive or ineffective, and, consequently, these insects are increasing from year to year. That the constantly growing decrease of our insectivorous birds and mammals has much to do with the alarming increase of insects is self-evident.

The decrease of birds is chiefly due to two causes, namely : The destruction of our forests and the wanton killing of these feathered friends of the forests by hunters and boys.

Years ago every farm had from five to fifty acres of woodland, besides this there were dispersed throughout the State larger tracts of woodlands. These lands, besides serving many other good purposes, were the natural resting and breeding places for birds, and served them as shelter during the heat of the day. Says a writer:

"I well remember the delight experienced in going to the woods in the spring of the year, and listening to the songs of the native warblers as they returned from their winter quarters at the south. The shrill whistle of the quail was as familiar to the ears of the farmer as household words. The scream of the blue jay rang through the forest clear and loud. The many species of woodpecker were watched with intense interest as they glided up and down the trunks of the trees, ever and anon rapping with irresistible force with their powerful beaks, and frequently drawing forth some huge grub that had been sapping the life of some monarch of the forest. While watching these ever-industrious and useful birds, a scarlet tanager, like a flash of fire, or some other bright bird, would flit by, happy and beautiful."

Such was the picture in those days ; but how is it now ? The birds have gone—no home, no resting place, no breeding place, no safety anywhere.

The birds that were so common in those earlier days, were mostly insect eating birds. They destroyed millions and millions of noxious insects. Insect predinations were then almost entirely unknown.

As trees are the best friends of man and forests of nations, so the birds may be said to be the best friends of the forest. And man—because the birds will eat a little grain, or help themselves to a few cherries, or, as is not unfrequently the case, to satisfy the desire of a cruel heart—kills them. Indeed, at the sight of such gross depravity, one feels ready to exclaim with Burns :

Inhuman man ! Curse on thy barbarous art,
And blasted be thy murder-aiming eye;
May never pity soothe thee with a sigh,
Nor ever pleasure glad thy cruel heart.

Fortunately a sentiment more favorable toward the birds is gaining ground. For several years rural associations have been considering the question regarding the utility of birds. But whenever and wherever this has been done, little or no notice was taken of the work, which these birds perform as protectors of the forests. This is a very important factor, and should be taken into consideration when the question, whether or not the bird is entitled to man's protection, is to be decided.

There can be no question as to the fact that certain birds do more harm than good. At all events man should be very cautious before he determines upon the extermination of certain species.

While the question is pending, let it be remembered that

"It was a heart with feeling pure and strong,
That prompted to the utterance of words
Of benedictions on the warbling throng,
'Blessed be the birds.'"

Among the mammals are quite a number which are to be counted among the friends of the forest, as for example, the mole, the shrew, the bat; but the greater number are injurious, such as rabbits, squirrels, etc. Ignorance destroys the first and protects the latter.

Before we can hope to know with any degree of certainty whether the debit of certain members of the animal creation is duly balanced by the credit, and therefore entitled to the protecting care of man, a very extensive series of investigation, and experiments, too, will be necessary.

In the meanwhile let us profit by whatever information we may be able to obtain.

The object in furnishing the following contributions to the forest-zoology of Ohio is two-fold—first, they are intended to help farmers and foresters recognize their friends in the animal creation, and, secondly, to stimulate observation and further researches.

THE RABBIT.

(*LEPUS SYLVATICUS*, BACKMAN).

Wood Hare, Gray Rabbit, Wood Rabbit.

[By A. L.]

Among the mammals the rabbits are without doubt the most formidable foes of the forest and the orchard. The rabbit belongs to the natural order *LEPORIDÆ*, which is characterized as follows*:

*Geological Survey of Ohio, Volume IV, p. 156.

— "Dental formula: i $\frac{2-2}{1-1}$ p. m. $\frac{3-3}{2-2}$ m. $\frac{3-3}{3-3}$ Molars rootless; hind legs and feet elongated; ears large and long; tail erect, bushy, short (sometimes rudimentary); fur usually soft, thick and loose; rami of lower jaw large, deep and flattened; orbits large; optis foramina confluent; palate reduced to a mere bridge between the premolars. The vertebræ processes are long and slender; acromium process of scapula provided with a spine at right angles to the axis of the scapula."

Specific characters: "Length from nose to tail 13.50 to 17.00 inches; hind foot 3.10 to 4.20; ear two-thirds length of head; head a little shorter than the hind foot. Pale yellowish brown above, varied with black; sides and rump grayer; nape and limbs yellowish rusty, fading into whitish on the anterior surface of the hind legs; head above less varied with black than the back; beneath white, except the breast, which is pale yellowish brown. The hairs of the upper surface have long shining black tips, succeeded by a broad bar of pale yellowish brown, then a narrower zone of black, and thence to the base grayish, plumbeous. Under fur dark plumbeous, nearly black, often tipped with pale brown."

During those seasons of the year in which the earth abounds in succulent herbs and grasses, the injury they do in the forest is hardly noticeable, but in winter, when the ground is covered with snow, they subsist chiefly upon the bark of young trees, and by girdling them cause the death of the trees thus attacked. Whole orchards have been ruined in this way, and in forests, protected from the inroads of cattle, young trees are destroyed, and thus the natural rejuvenescence of forests is prevented.

In countries abounding in rabbits laws have been enacted for their extermination. A few years ago the government of New South Wales advertised in New York papers a reward of \$125,000 for any process which would exterminate rabbits.

With us they are fortunately not so numerous as they are there, nor are our rabbits as large as those in New South Wales, yet the injury they do is sufficiently great to demand the serious attention of foresters and orchardists.

The best method of preventing serious damages is the complete extermination of these animals. This, however, is exceedingly difficult unless the State should pay a premium for killing them, which it is not likely to do. As the flesh is good in winter a most natural method of exterminating them is to encourage their hunting for the market. Where this is not done, and where hawks, owls, minks, weasels, and other natural foes of the rabbit have been destroyed, they increase in vast numbers, for the rabbit is very prolific, producing four to six young at a birth, and having three or four litters each year.

Wherever the rabbits are numerous, the owners of forests and orchards should look to means of preventing them from injuring their young stock.

A small area, such as a nursery, may be protected by an impenetrable fence. Individual trees have been protected by surrounding them with briars.

Among other preventives the following have been found of value:

1. Blood mixed with clay rubbed on the bark.
2. A mixture of lard and sulphur applied to the bark.
3. A coat of tar.

The applications should be from the ground upward to a height of several feet.

MOLES.

ORDER—INSECTIVORA; SUBORDER, TALPIDAE.

There is still a wide difference of opinions regarding the utility of the moles. Those who know the animal only by the furrows it plows through the ground and by the so-called mole-heaps, are, as a rule not favorably disposed towards it, while those who have studied its characteristics and its mode of life, do not hesitate a moment to pronounce it a useful animal, a friend of the forester, of the farmer and of the gardener, and strenuously advocate its protection.

The moles, of which two species are known to exist in Ohio, belong to the order of CARNIVORA, and suborder TALPIDAE.

1. THE EASTERN MOLE—*Scalops Aquaticus, Fisher.*

Of the Genus Scalops Cuvier says, that it includes moles, with the nose elongated and not fringed; the nostrils superior or lateral; eyes hidden, tail short, teeth 36 or 34, the two anterior upper ones unusually large, and somewhat like those of a rodent.

The Eastern mole has been described as follows:

"Average length from nose to root of tail $4\frac{1}{2}$ inches; of tail to end of vertebræ .95 inch; hand .85 inch; foot .75 inch; width of palm exceeds its length, and varies from .60 to .90 inch as the extremes. Eyes and ears excessively minute; the eyes not covered with integument, a minute orbital opening being apparent. Muzzle long and depressed; snout truncate at an angle of about 45° ; on this surface are the antero-superior nostrils; the flexible snout extends nearly three-eighths of an inch beyond the upper jaw. The tail is nearly naked. Color dark plumbeous, with occasionally a brownish tinge; feet, tail, nails and snout are of a light flesh-color. The hind feet are rather slender and weak, but this is made up by the great size of the spade-like hands, nearly an inch in breadth, attached by short, strong arms to robust shoulders. Feet not under the body, but standing out at the sides edge-wise with the palm. In short the whole form—the set of the limbs, great shoulders, short arms, broad hands and fossorial claws, united with the extraordinary muscular strength of the animal—adapt it to its method of ploughing through the soil, where it seems to travel as easily as on the surface. The earth seems scarcely less dense when one of these animated little ditchers is seen gliding along, not over, but literally *through*, the meadows, leaving his well-arched viaduct behind him, than does the water in the adjacent streams before the thrust of some sharp-nosed and large-finned darter or sun-fish."

In motion, says Kennicot:

"The fore feet are thrust forward at the sides, with the edges answering to the thumb of a man's hand, placed downward, and the nails taking hold in the earth; the body is drawn along with ease and rapidity, as a row-boat is propelled by oars, the hind legs carrying the posterior parts. Those I have observed burrowing through unbroken soil appeared to loosen the earth in front with the long snout, and then to thrust it aside with the fore feet by the same movement which carried the body forward, the ground being raised above by the upward pressure of its powerful head and shoulders. The snout was kept in constant motion, undoubtedly as much in search of food as to loosen the particles of earth for the passage of the body."

2. HAIRY TAILED MOLE—*Scapanus Breweri*, Jordan.

The dental formula of this animal is as follows:

Upper jaw	3	4	1	6	1	4	3	$= 22 = 44$
Lower jaw	3	4	1	6	1	4	Molars.	
			Canines.		Canines.	Premolars.		
			Molars.					

The nostrils are near the end of the muzzle.

Prof. A. W. Brayton gives the following description of this mole:

A specimen in alcohol measured 1.65 inches from tip of nose to occiput, four inches to root of tail; tail, 1.05 inches; tail end of hairs, 1.25 inches; length of hand, 0.72 inch; of foot, 0.75 inch; breadth of palm, 0.55 inch. The body is rather more slender than *Scalops aquaticus*. The head is rather pointed and elongated, owing to the great development of the muzzle, which projects about one-third of an inch beyond the incisors. The muzzle is depressed, tapering to a rounded truncate tip. There is a broad groove on the under side from the incisors to the bulb of the nose, which is terminal and smooth. The remainder of the muzzle is wrinkled and corrugated. Nostrils open on the sides of the terminal bulb; they are slightly visible from above, but not from beneath. The eye is minute, and covered with skin; it is a little back of the angle of the mouth, and midway between the tip of the snout and the occiput. There is no external ear; the auditory opening is an oval cavity, about one-twelfth of an inch in diameter, situated just above the insertion of the arm. The tail is thick and blunt at the end, entirely and densely covered with rigid hairs about one-sixth of an inch long. The third finger is longest; the second about the same size but not as long; the fourth smaller and shorter; the first is larger than the fifth. The palms are about as broad as long, exclusive of the claws; these are long and fossorial, and much larger than those of the hind feet. The hind feet are narrower and weaker than the fore, although about the same length. The under surface of all the feet are perfectly smooth, the upper with scanty hairs. There is a sciliated border of short hairs about the posterior and lateral margin of the palm. The fur is long and full, the longest hairs on the back measuring 0.35 inch. Above the fur is an ashy plumbeous from the roots, glossed with ashy-brown; this ashy-brown tinge is more decided beneath, and extends more toward the roots; toward the chin there is a slight tinge of reddish-brown. The hairs on the sides and extremity of the tail are tipped with silvery."

Early in spring, when the soil is wet,* or moist,† or fresh,‡ the mole

* A soil is called *wet*, which, when taken in the hand, drops water without being pressed.

† Soil is called *moist*, which, when pressed, drops water.

‡ Soil is called *fresh*, which, when pressed leaves traces of moisture in the hand.

furrows the ground within two or three inches from the surface. It is only in very dry weather during the summer, or autumn, or in winter, when the insects, its only food, (for the mole is not known to depart from its insectivorous habits) go deeper, that the mole will go deeper. The insects, which constitute the food of this animal, are without an exception injurious to vegetation. And yet man, blinded by prejudice or ignorance, will make war upon the mole.

Thus there appeared in the *Country Gentleman* of November 10, 1887, a communication under the heading of

MOLES IN GRASS LANDS.

Moles are said to be carnivorous in their habits, feeding only upon worms, grubs and other insects. No doubt they do consume a great many injurious insects, as cut worms, white grubs of the May beetle, earth worms, and other subterranean prey; but that they also eat peas, sweet corn, and other vegetable matter, I know, because I have examined the contents of their stomachs and have found the starch cells and fibrous matter of sweet-corn which they have devoured as it was planted. Every one knows how these pests will follow a row of newly planted peas, corn or potatoes and eat the seed.

The writer goes on telling what means he employed to destroy them. Mr. Edward A. Samuels, in an able essay, "The Pests of the Farm,"* emphasizes that care should be taken in destroying the short-tailed field-mice, not to include the shrew-moles and moles, which, he says, are eminently beneficial, their food consisting of insects and larvae. If the teeth of both shrews and moles be examined, they will prove that vegetable food could not form part of the animal's diet, for they are very small and fine, and the strong, sharp, chisel-shaped incisors which all the rodents or gnawing animals possess are wanting, their place being supplied by fine teeth, incapable of severing any but insect food. There are in our papers, frequently, articles in which appear long descriptions of the depredations of the moles, and full directions are given for their destruction. Now when it is taken into consideration that these animals are incapable of devouring vegetable food, and even if they were not they could not digest it, these articles, to say the least, are unnecessary and mischievous.

Kennecott observed that moles kept in confinement, ate sparingly of potatoes and lettuce, but died in three days, while others kept in barrels in each of which both vegetables and softened and dry corn were abundant, died without eating them.

From our present knowledge of the mole we are led to believe that the animal should be protected.

*In abstracts of returns of the agricultural societies of Massachusetts, edited by Charles L. Flint. 1869, p. 85.

THE HEDGEHOG OR PORCUPINE.

ERITHIZON DORSATUS—F. CUVIER.

The fact that the European Porcupine* *Erinaceus Europaeus*, is known to be the forester's friend, inasmuch as it is an enemy to mice and other vermin, which are injurious to forests and forest trees, has led some people to believe that the North American porcupine is also a friend of the forests, and therefore entitled to protection. To correct this error a brief account of this animal will not be out of place.

Prof. A. W. Brayton describes the porcupine as follows:†

General color brownish-black, varied above with yellowish-white. Body densely clothed with long, soft, rather woolly hair, intermixed with straight, coarse hair and bristles. The latter are four to six inches long, usually tipped with yellowish-white, the light tip from one-fourth to seven-eighths the length of the hair—rarely obsolete or extending to the base. Beneath this, and usually concealed by the pelage proper, or the dorsal surface, are erectile barbed quills, from one to four inches in length. These are usually white at the base and black at the tip, the black varying from one-tenth to one-fourth the length of the quill; a few are entirely black, and others occur entirely white. The quills begin at the nose ashore, stiffened, pointed hairs, pass into short spines between the eyes, and so continue to increase in size posteriorly, becoming longest over the hips, on the lower part of the back, and upper side of base and tail; toward the end of the tail they pass again into long, thick bristles and stiff hairs. The young are born without quills, and of a uniform black color. Adults average thirty-five to forty inches in total length; the head is about six inches, and tail vertebræ about the same.

The porcupine is essentially a forest animal, and has disappeared in those sections of the State where the forests have been cut down. Dr. Ralph W. Seiss, says in an article‡ on this animal:

The food of this creature consists of the inner bark of trees, and also of their leaves. It seems to prefer the bark of the hemlock (*Abies Canadensis*), but is also fond of the bass-wood, slippery elm, and other species. When a porcupine has taken up its residence in a strip of woodland, it generally remains until the supply of food is exhausted, barking the trees in succession, and so destroying a large amount of valuable timber. It is hated by hunters as well as by lumbermen, for their dogs are frequently injured or killed in tracts where the hedgehog is abundant, by charging open-mouthed on the quills and so filling their mouths with the sharp spines, which work their way in deeper with every motion of the dog, and finally kill the animal by the inflammation they cause, if not speedily removed with care and skill.

This species is the most sluggish animal found on our continent outside of the tropics; all its motions are slow and very deliberate. If surprised on the ground, it

* The European porcupine is a widely different animal, belonging with the mole and other similar animals, to the family of Talpidae.

† Geol. Surv. of Ohio, Vol. IV, p. 155.

‡ In Country Gentleman.

walks slowly away, and if kicked or struck, rolls itself up into a ball, and with its head between the fore legs, sharp spines erected, and its tail whisking rapidly from side to side, presents an invulnerable array of bristling spines and coarse, strong hair, to the rough intruder. These spines cover the entire upper surface of the body. They vary in length from one to three inches; the points are sharp and barbed at the sides, and the quills are but loosely rooted to the skin, so that when they pierce a soft offending body, they stick in it, and come away firmly imbedded in the mass. The animal can erect his *chevaux-de-frise* at pleasure, and when rolled up with all the spines raised, presents only a bristling array of short barbed points. Panthers, wildcats and wolves have more than once been found in the forest dead of starvation, their mouths, tongues and lips full of these spines. Owing to the peculiar set of the barbs, the quills work their way further and further in with every movement of the animal which they have pierced, finally producing very severe injuries.

It is entirely an error that the porcupine can shoot its quills; as above stated they drop out as soon as touched roughly, and this accounts for the widespread belief among hunters, trappers and guides on this point. These quills are much used in the celebrated Indian ornamental work; they are dyed various bright colors, and moccasins, cartridge belts and pieces of wearing apparel and numerous fancy articles are ingeniously and tastefully ornamented with them. The flesh of these animals is said to be fair eating, and to resemble roast pig. The porcupine makes its nest in hollow trees or in rock caves, and produces from two to three young in April or May. It does not hibernate like the wood-chuck and many other rodents, but keeps active through the coldest weather, generally passing the night in a hollow tree, and spending the day in feeding on tree-bark. The powerful gnawing teeth and the peculiarly formed molars are especially adapted for grinding up this coarse and fibrous food.

The hedgehog is an excellent climber, and the whole form is strong and muscular. This specie can be shot or knocked down with the greatest ease.

In the days when the war upon our woodlands was justified the porcupine was, to some extent, an ally of man, but at the present day, when only about 15 per cent. of the superficial area of our State is in woodland, this animal should be exterminated.

BATS.

ORDER—CHIROPTERA.

The utility of many of the so-called useful animals is often counterbalanced by the injury they do, hence it is that the propriety of calling them friends is frequently questioned. Not so with the bats of Ohio, for all the species that occur in this State are highly beneficial. Unfortunately superstition and ignorance have prevented men from recognizing this fact. Dr. H. Allen says on this subject:

Attendant as they are upon the quiet hours of twilight, when the thickening is conducive to the development of superstitious feeling, bats have always been associated with ideas of the horrible and the unknown. In olden times, when the imagination of the people exceeded the accuracy of their observations, it was one of the numerous monsters inhabiting their cabins and forests. It has done service in many a legend; its bite was fatal; it was the emblem of haunted houses; its wings bore up the dragon

slain by St. George; its image is rudely carved upon the tombs of the ancient Egyptians; the Greeks consecrated it to Proserpine; it is part of the infernal portion of the witches of Macbeth, while Aziel employs it in his erratic flights. In art its wings have entered largely into the creation of those composite horrors—evil spirits; nor have modern artists escaped the absurdity of encumbering the Satan of Holy Writ with like appendages. But of this association with the monstrous, the intelligent observer ceases to take note, when the finer beauties of structure develop themselves under his gaze. Upon acquaintance, he learns that in anatomical and physiological peculiarities, and zoological position, the bat is a subject for study worthy the attention of the most contemplative.

Ignorance of its mode of living lead to the idea that the bat was chiefly carnivorous—that it was more especially fond of bacon. It was consequently slain wherever it was found. Modern science has shown beyond a doubt that all bats in this State are exclusively insectivorous, and what is especially noteworthy, is the fact that they feed upon injurious insects only. Some foreign species, says Prof. A. W. Brayton, are strictly frugivorous. Our species subsist on insects, mainly the crepuscular and nocturnal kinds, as gnats, moths, mosquitoes, and even the heavily mailed coleoptera. And Dr. Allen says of them the disappearance of the birds of day is a signal for the advent of the dusky host, which, as it were, temporarily relieve from duty their more brilliant rivals in guarding the interests of nature.

Many of the so-called nocturnal insects, which escape the birds entirely, would multiply to an alarming extent were it not for the bats.

Few people have any idea of the ravenousness of these animals. Prof. Carl Vogt, carefully examined the excrements of bats which he took from the famous castle of Heidelberg, and found in one cubic centimeter of the same, forty-one remnants of legs of different, larger and smaller insects. From this he computed that one cubic foot of such excrements would contain the digested cadaver of 184 000 insects. In old ruins and under the roofs of churches, he found piles of excrements of bats amounting to five-tenths cubic foot, which would represent the cadavers of more than one and a half millions of insects. True, these excrements were not the product of a single season, nor of one animal, yet it must be remembered that bats drop the greater portion of their excrements while flying, and that the great quantity found by Prof. Vogt was the accumulation of a very small portion of the droppings of the bats.

The following five species are known to be indigenous to Ohio:

1. Little brown bat—*Vespertilio subulatus*. *Say.*
2. Silver black bat—*Vespertilio noctivagans*. *Le Conte.*
3. Carolina brown bat—*Vespertilio fuscus*. *Beauvois.*
4. Red bat—*Atalapha Noveboracensis*. *Erxleben.*
5. Hoary bat—*Atalapha cinereus*. *Beauvois.*

FACTS ABOUT BIRDS AND THEIR MODE OF LIVING, COLLECTED FROM VARIOUS SOURCES.

AMERICAN STARLINGS

[Prof. J. W. Robson, of Kansas, in Kansas Farmer, July, 1888.]

The cow bird and the bobolink form a small group which connects the finches with the true blackbirds; the shape of the bill showing their alliance with the former, while the feet, wings, and other characteristics establish their position with the latter. The hanging-birds (orioles) belong also to this family, so do the crow, blackbirds and the meadow lark. They are decidedly insectivorous during the spring and early summer, living upon beetles, bugs, caterpillars, grasshoppers, crickets, and upon all kinds of insects, large and small; during the fall months they live principally upon seeds and corn.

The Baltimore oriole receives more anathemas from the horticulturist, than any other of our native birds. He is accused (perhaps justly) of devouring large quantities of strawberries, cherries and grapes, evidently preferring to mingle his beetles and bugs with small fruits at the proper season; thus taking his pay for labor previously performed. The orchard oriole is a familiar occupant in our orchards and gardens in summer, where it renders signal service by ridding the fruit trees of hosts of worms and noxious insects and their larvæ; this bird ought to receive the protection of every orchardist.

THE ORIOLE AS A WORM DESTROYER.

[A. M. G., Rockville, Ct., in Country Gentleman, June 22, 1882.]

A friend of mine reports the following incident as a proof of the worm-destroying qualities of the Baltimore oriole: While engaged burning out the nests of tent caterpillars in his orchard by means of a swab saturated with kerosene, and ignited at the end of a pole, one nest was found too high to be reached. While he stood, considering how he could get at it, an oriole flew directly upon the nest, picked it open, took out a worm or two, and flew away, returning almost immediately with its mate, when the two commenced active operations in cleaning out the entire colony, and carrying away their victims, apparently to feed their young. After watching them awhile, my friend came away, and the

next day upon returning, found nothing remaining of the entire affair but a few dangling shreds of the late populous worm village. The orioles had done their work thoroughly and with expedition. Do not let them be destroyed or molested.

PROTECT THE BIRDS.

[Geo. Eby Lozer, Stark County, Ohio, in Ohio Farmer, June 2, 1886.]

Within the last few years the destruction of our birds has increased at a rate that is alarming. We should have a revival of interest in the protection of our birds, for many species are growing scarcer every year. We shall awake some day to the necessity of protecting and encouraging our native insectivorous birds all we can. Children should be taught to regard a bird's nest as little less than sacred. Ohio has laws making the killing of song birds an offense punishable by a fine of from \$50 to \$200. The fine is right, for the birds are more valuable to mankind than their worthless murderers. A noted professor of Normal, Ill., examined eighty-six blue-birds, and estimated that each of these birds eats upwards of thirty insects a day.

Although it is impossible to get the exact number of birds killed each year, we know that a single taxidermist stuffed 30,000 bird skins in one year. About 70,000 birds were brought to New York in four months, time. One firm had on hand, February 1, 1886, 200,000 skins. American women are charged with the responsibility for the annual murder of 5,000,000 birds for the adornment of their hats.

The loss of so many birds is one the world can not afford. These figures tell their own story, which might be known even without them. We may read it plainly enough in the silent hedges, once vocal with the morning songs of birds, and in the deserted fields where once bright plumage flashed in the sunlight. The objections to this cruel and wanton destruction of bird-life are not sentimental only. If continued it will soon not only deprive us of one of the most attractive features of rural life, but *it will surely work a vast amount of harm to the farmers by removing one of the most efficient checks upon the increase of insects.* Agricultural interests are at stake.

KILLING THE ROBINS.

[A. N. V., Aiken, S. C., in Country Gentleman, February, 1888.]

Having to seek the warmth of the "Sunny South," as does our robin red-breast for five months of every year, it is most painful to witness the

wanton destruction of that favorite of birds by gunners, both men and boys, both white and black, at every hand, while boys innumerable are to be seen killing them with slung-shots to the extent of fifteen to twenty-five in a forenoon and selling them for a paltry sum. I venture to say that twenty-five per cent. of all the robins are killed in the South every winter; without exaggeration the percentage of those killed is greater than twenty-five per cent., rather than less.

The birds live in large flocks at the South, which is to their destruction, and to the pleasure of their heartless persecutors.

To enact laws at the North and not at the South is but half doing what is necessary to prevent their extermination. I write this hoping that you will lend your influence that the States, especially South Carolina, Georgia and Florida, may be suitably requested to pass laws for the protection of the northern song-birds, as have New York, and I believe, all the rest at the North.

DESTRUCTION OF BIRDS.

[Thomas D. Baird, in Prairie Farmer of October 6, 1888.]

The practice of shooting and otherwise destroying these beautiful and useful companions of our race—a practice most particularly followed by our city cousins—is one which every sensible and reflecting person will not only sincerely deprecate, but studiously endeavor to restrain. To the farmer and gardener and the forester, too, birds of all descriptions are of incalculable advantage. I know some farmers and gardeners think that certain birds are destructive pests and should be destroyed. Birds, however, not only serve as active and vigilant protectors of our crops, but they also afford by the tuneful melody of their songs a source of the purest and most exquisite delight. The farmer who has any love of nature about him, is always delighted and cheered by these songsters in his daily toils on the farm. In fact, all nature seems to have been arranged for the express benefit and happiness of man. To whatever division of the great realm of life we direct our views, we shall find that this important fact is most amply demonstrated and borne out.

If, in the summer, we direct our steps to the fields and cultivated lands of the toiling farmer, we shall there behold the laws of instinct operating upon the mundane soil for the special and powerful protection the products of his hands; we shall there discover at once, not only the

utility of those harmless and inoffensive objects, but be enabled also to deduce the most ample and satisfactory corroborations of the poet's words:

"All are but parts of one stupendous whole,
Whose body nature is, and God the soul."

By taking notice of the habits of birds, it will be seen that each species feeds upon a particular species of insects. By the destruction of birds wholesale, as it is practiced at this day, we work against our own interest, by encouraging the propagation and increase of the insect tribe.

At this season of the year we often see city gents ride out to the country, lay down the farmers' fences without permission, set their nets and drive into this snare these little co-workers of the farmer, the quails, and carry off at one time twenty-five to thirty quails, which are worth one dollar each to the farmer, without thinking that they had damaged him a cent. And we often see the farmer and his boys thoughtlessly trying their skill as marksmen shooting their little friend the sparrow-hawk. These birds will destroy thousands of insects that are injurious to the crops, without asking one grain or chick of them. We have watched these little hawks for forty years, and have never seen them destroy any thing of value to the farmer. A single sparrow will, if permitted to pursue its harmless avocation undisturbed, do more towards the preservation of the garden than the most careful hand. The robin also, and the various other species of birds with which our fields and forests abound, are all co-workers with the farmer and gardener, and should be protected and treated with the kindness they deserve—in fact the farmer and gardener should do all they can to encourage them around their premises, setting out fruit and other trees, forming beautiful groves for them to dwell in and rear their young. Nature has designed them for a wise and benevolent purpose, and endowed them with instincts, the tendency of which is to render them the friends rather than the foes of man. Think of this, farmer; think of this, gardener; think of this, statesmen.

A PLEA FOR INSECTIVOROUS BIRDS.

Let me put in a special plea for insectivorous birds, which appear to have been sent to keep up "the balance of power" in insect life, which insects would otherwise multiply to such a degree as to be perfectly unbearable, and render the agriculturist's toil entirely useless. A farm keeps a watch dog to watch his premises, and cats to kill rats and mice his granary and barn; yet he suffers any "unfeathered biped" to tear down his fence rails in order to get a chance shot at any robin, wren or blu bird, which may be unfortunate enough to be on his premises; and y

these very birds do him more good than either dog or cat, working diligently from morn to dark, killing and destroying insects injurious to his crops, which, if not thus thinned out, would eventually multiply to such an extent, as to scarcely leave him any crop whatever. Birds are accused of eating cherries and other fruits. True, but the poor birds merely take a tithe of the fruit to pay for the tree, which, but for their unceasing efforts, would otherwise probably have been killed in its infancy. To exemplify the utility of birds, I will give one or two instances that have occurred under my own observation.

Some years ago I took a fancy to keep bees; accordingly hives were procured, and books read upon the subject. One day a king-bird, or bee-martin was observed to be very busy about the hives, apparently snapping up every straggling bee he could find. Indignant at such a breach of hospitality, as his nest was on the premises, I hastened to the house to procure a gun to shoot the marauder. When I returned I perceived a grayish bird on the bushy top of a tree, and thinking it was the robber, I fired, and down dropped a poor innocent phoebe bird. Hoping to find some consolation to my conscience for having committed this most foul murder, I inwardly accused the poor little phoebe of having also killed the bees; and, having determined to ascertain the fact by dissecting the bird, it was opened, when, much to my regret and astonishment, it was found to be full of the striped cucumber bugs, and not a single bee. Here I had killed the very bird which had been working for me the whole season, and perfectly innocent of the crime for which it was sacrificed. After this circumstance I determined never to let a gun be fired on the premises, excepting on special occasions; and at present the space is perfectly crowded during spring, summer, and autumn, with the feathered songsters, which build their nests even in my very porch, and bring up their young perfectly fearless of mankind; and although cherries, strawberries, etc., do suffer, yet the insects are not a quarter as numerous and troublesome as they were formerly.

In the southern States I have seen a bee-martin chase and capture a ball-worm moth not ten paces from where I stood, and the mocking bird feeding its nearly grown young on the same insect.

TOWNSEND CLOVER.

WOODPECKERS.

Wilson, speaking of the little downy woodpecker, says:

'Of all our woodpeckers none rid the apple-trees of so many vermin as this, digging off the moss which the negligence of the proprietor had suffered to accumulate, and every crevice. In fact, the orchard is his favorite resort in all seasons; and

his industry is unequalled, and almost incessant, which is more than can be said of any other species we have. In the fall he is particularly fond of boring the apple-trees for the insects, digging a circular hole through the bark just sufficient to admit his bill; after that a second, third, etc., in pretty regular, horizontal circles round the body of the tree; these parallel circles or holes are often not more than an inch or an inch and a half apart, and sometimes so close together that I have covered eight or ten of them at once with a dollar. From nearly the surface of the ground up to the first fork, and sometimes far beyond it, the whole bark of many apple-trees is perforated in this manner, so as to appear as if made by successive discharges of buck-shot; and our little woodpecker, the subject of the present account, is the principal perpetrator of this supposed mischief. I say supposed, for so far from these perforations of the bark being ruinous, they are not only harmless, but I have good reason to believe really beneficial to the health and fertility of the tree. I leave it to the philosophical botanist to account for this; but the fact I am confident of. In more than fifty orchards which I have myself carefully examined, those trees which were marked by the woodpecker (for some trees they never touch, perhaps because not penetrated by insects) were uniformly the most thriving, and seemingly the most productive; many of these were upward of sixty years old, their trunks completely covered with holes, while the branches were broad, luxuriant, and loaded with fruit. Of decayed trees, more than three-fourths were untouched by the woodpecker. Several intelligent farmers with whom I have conversed, candidly acknowledge the truth of these observations, and with justice look upon these birds as beneficial; but the most common opinion is, that they bore the trees to suck the sap, and so destroy its vegetation; though pine and other resinous trees, on the juice of which it is not pretended they feed, are often found equally perforated. Were the sap of the tree their object, the saccharine juice of the birch, the sugar maple, and several others, would be much more inviting, because more sweet and nourishing, than that of either the pear or apple-tree; but I have not observed one mark on the former for ten thousand that may be seen on the latter. Besides, the early part of spring is the season when the sap flows most abundantly; whereas, it is only during the months of September, October and November, that woodpeckers are seen so indefatigably engaged in orchards, probing every crack and crevice, boring through the bark, and, what is worth remarking, chiefly on the south, and south-west sides of the trees, for the eggs and larvae deposited there by the countless swarms of summer insects. These, if suffered to remain, would prey upon the very vitals, if I may so express it, of the tree, and in the succeeding summer give birth to myriads more of their race equally destructive.

Here, then, is a whole species, I may say, genus, of birds, which Providence seems to have formed for the protection of our fruit and forest-trees from the ravages of vermin which every day destroy millions of those noxious insects that would otherwise blast the hopes of the husbandman, and which even promote the fertility of the tree, and in return are proscribed by those who ought to have been their protectors, and incitements and rewards held out for their destruction! Let us examine better into the operations of nature, and many of our mistaken opinions and groundless prejudices will be abandoned for more just, enlarged and human modes of thinking.

BIRDS AND INSECTS.

[From an Essay on Utility of Birds to Agriculture, by Frank H. Palmer, in Agriculture of Massachusetts, 1871-72.]

It is a universal principle in the whole realm of nature that animals and plants live by the destruction of other animals or plants. So life

transmitted into higher life, and a chain of existence is formed, one link of which being broken, disastrous results are sure to follow.

Now nature, if left to herself, establishes this wholesome equilibrium between the feathered and the insect tribes, viz: She produces no more insects than can be kept in check by the birds.* But man, by his artificial habits, disturbs the proper balance between these tribes. By cutting down the woods, by disturbing the quiet of the forest by the sharp report of the gun, he destroys or drives away the birds, and thereby stimulates the production of insects, which become almost the greatest pests of the agricultural interests of the country. The extent of the evil caused by the infringement of these natural laws is easily demonstrated; first, by reference to the undoubted facts of past experience, and secondly, by showing what must surely follow the destruction of birds. It is estimated that at least 5,000,000 bushels of wheat are yearly destroyed by insects in the United States. One hundred thousand rose trees were lost by one florist in France, being destroyed by insects. Wilson says: "Would it be believed that an insect no larger than a grain of rice should silently and in one season destroy some *thousand acres of pine trees*, many of them from two to three feet in diameter and a hundred to a hundred and fifty feet high?" And many other like instances of the destructiveness of insects might be mentioned, but we pass to the consideration of what must follow the destruction of birds.

The reproductive energy of insects is truly wonderful. It is said that a single pair of grain weevils have produced 6,000 young between April and August. The common varieties of aphides or plant-lice, which are found on almost every kind of plant, are produced first from eggs laid the season before, and then through the summer only females are developed. At the last of the season males and females both appear, and eggs are laid for the brood that hatches early in the spring. Reaumer says that one individual in one season may become the progenitor of six thousand millions. The silk-worm moth produces about 500 eggs; the great goat-moth about 1,000, the tiger-moth 1,600, the female wasp at least 30,000. There is a species of white ants, one of which deposits not less than 60 eggs per minute, giving 3,600 per hour. Such, then, is the enormous fertility of insects, and some of them breed several times a year, while most insectivorous birds breed but once a year, and then produce but four or five young. But nature has given to birds an appetite and an instinct which teaches them exactly when and how to go to work to capture and destroy insects and their eggs; and if the number of eggs produced by insects is wonderful, so the number destroyed by a single

*And some mammals, too. A. L.

bird is marvelous. Bradley says that a pair of sparrows will destroy 3,360 caterpillars in a single week. A young martin on a church spire, opposite our window, was visited five times in as many minutes by the parent bird, each time with an insect. A brood of partridges will nearly exterminate the denizens of an ant-hill in a single day. Woodpeckers are incessantly employed in ridding the orchards of insects and their eggs, which they skillfully discover under the pieces of dead bark. Robins, throughout the spring and summer, are continually digging for worms and grubs which they find concealed beneath the surface of the ground. A day or two since we noticed a common chipping-sparrow capture a moth, and, upon depriving it of it, we found it to be that of the common apple-tree caterpillar (*Clisiocampa Americana*), so destructive to the orchards of New England. It is easy to see then, how, when birds, the natural enemies of insects, are destroyed and driven away, it will follow that insects will increase, and an increase of insects is synonymous with a decrease of crops.

THE THRUSHES.

[Dr. John E. Douglass, Jr., Cincinnati, O.]

These sketches were written for this report at my request.—[A. L.

I. THE BROWN THRUSH—*Harporthynchus rufus*. *L. Cab.*

When the Thrush at day-break warbles
Songs of love unto his mate,
And the lilacs' fragrant perfume
Steals around you early, late—
When the orchard blossoms cluster
In their groups of pink and white,
Then it is the heart is merry
And the soul is all delight.

—*Fragment.*

The brown thrush by common consent is the favorite song bird of our north. He arrives about the 10th of April, a little earlier or later, as the season is retarded or advanced; but when the lilacs are in bloom he is in full song. To-day, all is silence save the chirping of the inferior singers, but to-morrow his joyous notes will burst upon you like an unexpected pleasure. All through the fragrant season of buds and blossoms is heard his sweet madrigal that awakens the tender lyric chords in the human heart.

The brown thrush is not the bird to live in obscurity. You can not pass through the country in the early morning of blooming spring without having your ear charmed with the rich notes which, with such nicety of modulation, fall from you know not where.

The eye wanders in search of him from tree to tree, till at last, upon the very topmost bough he is seen gently swaying in the morning breeze with the rise and fall of his song. In size he is somewhat larger than the familiar robin, but of a more slender and elegant form. The back and wings are of a rich, tawny russet, and the breast and sides are light, spotted with dark brown. Decked in his rather sober suit, he leads you to think he is of a prosaic turn, while in truth his nature is the most poetic.

Though he is inclined to be friendly, there is a cautious dignity about him that demands respect. Upon your too near approach he watches you with his beautiful yellow eye, with an expression of half curiosity, half distrust; and at last, when compelled to seek safety in flight, it is with drooping, fluttering motion.

Unlike his European cousin, the storm-cock, whose song is loudest when the snow blows fiercest, he leaves his northern home ere the frost has chilled the air, to spend the coming winter in the genial south. When the season for his northern migration arrives, it is amusing to watch his curious flight.

Along the banks of streams from bush to bush, across logs and where the underbrush is the thickest, he steals cautiously along like a scout in the enemy's country. Now he is silent and shy, his only note, that of alarm, is a quick, sharp chirp, but when in company with his mate he has reached the breeding ground, his whole aspect is changed as if by magic. He is no longer a timid, skulking traveler, but a bold, rollicking lover, perfectly at home, and conscious of his power to please.

In his song, he is to the north what the mocking-bird is to the south. Possessing an accurate and varied range of imitation, his notes sweet and clear, only suffer by comparison with the far-famed southern bird's.

The brown thrush, or French mocking-bird, as he is sometimes called, has not a little eccentricity and conceit. He seems to prefer the prominent trees near a house or public highway, where he can be heard and seen, and there perched upon the topmost bough, his rich rhapsody is poured forth with untiring ecstasy.

When the dusky scenery of night is shifted and the purple curtain of the dawn is raised he is the grand leader of the feathered orchestra. Over and over he repeats the notes of the different birds, as if to teach that expression and arrangement is the key to melody.

At the height of his tuneful revelry his vain dignity is relaxed, and he sits with tail adroop and head thrown back, the very soul of song.

Then, as the heated hours approach he leaves his exposed and lofty bough and seeks the shady seclusion of the thicket, to feed and rest during the day. He is insectivorous in his diet; the friend of man and the forest; charming the former, protecting the latter. His hours of useful-

ness and pleasure are nicely balanced so that when evening draws nigh, again he mounts his favorite branch and continues his delightful performance, which only ceases with the setting sun.

But the romance of his honey-moon is soon over, and he settles down with a royal will to the bitter and sweet of matrimony.

The building of a nest is a most important care ; the chosen site is a matted brush-heap, stump, leafy bush or tree, and even on the ground, when early in the season, the leaves are scant and unconcealing. Here and there he searches for material with the nicety of the architect's artificer ; leaves and small twigs are loosely interlaced and the nest is lined with bark fibers, rootlets and the softer leaves. The nest once finished, the imposing task of raising the brood commences.

The eggs are from a white to a light blue color, thickly spotted with reddish-brown, and usually four in number, though sometimes the fifth is deposited.

When every thing has caught the busy bustle of advancing spring the poor female is compelled to remain an anxious but not an idle spectator. During the tedious days when time hangs heavy, the male bird cheers her hope and courage with his mellow song. Not far off, upon a flaunting bough, his two-fold mission is to please and guard.

Let but an enemy now approach, and he darts upon him like a very fiend, and with a bravery that, among the birds, is unexcelled.

At length, as the days roll by, suddenly there is a great commotion and splutter in the nest, and four gaping, greedy mouths are never satisfied. The distracted mother sets off on long and weary forages full of anxiety for that unguarded home, which the ill-reputed, thieving jay may plunder.

The male bird also supplies the family board ; perhaps awkwardly enough at first, but he soon drifts in that steady routine, that reminds one of the once jolly young bachelor, now hampered with the matrimonial knot, and trudging with his market-basket home.

What a gulf between the poetic and the realistic ! The thrush no longer pipes his merry notes ; poor fellow ! Where before he sang, he must now "dance to another tune." At last the young birds leave the nest, and he seeks a long vacation amid the haunts of his poetic days.

Little he cares to wait for the gipsy landscape of our Indian summer and when September is at hand, he wings his southern flight only to return with the lilacs of the spring, to a life of usefulness, of song and devotion.

II. THE CAT BIRD—*Mimus Carolensis (L.) Gr.*

Hear him lilting,
See him tilting
His saucy head and tail and fluttering,
While uttering
All the difficult operas under the sun,
Just for fun.

—Venable.

The cat bird, unjustly, is stigmatized a robber. It has always been the privilege of every small boy to hurl a pebble at the bold intruder as he mews a defiance from the hedge row, or from the trees by the garden walk.

He arrives in April shortly after the brown thrush, but he seems to be less attached than that bird to the places that have known him before.

It is enough for him that he has a sheltering shrub or bushy tree wherein to build his nest, and he neither asks nor expects much friendship from man. Every-where in the country he is a familiar bird, and though never so numerous as the robin, he far out-numbers the brown thrush.

In his quaker garb of dark slate color, he assumes a half bold, half prudish air that is quizzical.

After the construction of his home, which is mostly of dead twigs, and while his mate patiently warms the four greenish-blue unspotted eggs, he commences his song which is at first soft and plaintive enough. In his more relenting moods he will even approach close to the porch or window where you are sitting, and while he sways on a lithe bough, he will pour out a perfect ripple of soft exquisite notes; but they are never of such beauty or volume as those of the brown thrush. In fact these are only his practice lessons. From day to day he has been listening to the beautiful matin praise and vesper hymn of the brown thrush and soon he is to prove that he has been an apt pupil.

His self confidence seems to increase with the advance of the season, and then he is prodigal of his sweet melody. He sings here and there, every-where, the live-long day. No more *practice lessons* for him. He now considers himself a *master* and he is.

Though he is inferior to the mocking-bird to whom he is so closely related, and not an equal of the brown thrush from whom he has learned so much, in his conceit he knows no rival.

He is as capricious as a school girl and jolly as a bacchant. There is something extremely effeminate about the cat-bird inasmuch as no one understands him, and in that he does not even understand himself. He sings his song and is conscious that he does it well; and concluding his weakish cat-call says: A fig for your applause! His beautiful notes charmed

your ear; he gave you for your attention an insult and a moment later ashamed of having committed a misdemeanor, away he skulks a puzzle to himself and all who know him. He has all the eccentricities of the poet, the musician and the artist. Nothing is too good for him and at times nothing too bad.

Even when the young are hatched and food must be furnished he still finds time for song; and will now and then burst forth in a rhapsody that seems to be a poetic expression of gratitude, love and tenderness for his mate.

Between feeding his family and singing his songs he is always in a hurry. He has the eager haste of the bee, but not the miserly propensities. He only gathers the liquid meliferous notes to give as freely as he takes them.

If he is fond of singing he is also fond of rich and dainty food. Worms, insects and spiders form a large part of his diet; and you may always find him in the garden or the cherry trees, where the finest and ripest berries and the richest and sweetest cherries grow. Upon this delicious food he delights to feed and may be—gormandise; and for this he has been stigmatized a robber without a word for the good he has done in the destruction of harmful insects.

But alas! he too suffers the fate of all who become sensualists. His beautiful song which is the soul is gone and forgotten, and now he has only the vulgar cat-call of which he even seems proud.

Till, at last when the melancholy of October steals upon us like a sigh; when all life in nature seems to linger in one parting breath, the cat bird with his same old saucy mew spreads his wings and sails away to the south.

And then after all when he has gone we can not help but forgive him when we remember his beautiful song, his usefulness and persecution.

III. THE ROBIN—*Turdus Migratorius. L.*

The north wind doth blow,
And we shall have snow,
And what will the robin do then poor thing?
 He'll fly to the barn,
 And keep himself warm,
 And hide his head under his wing.

—Old Nursery Song.

Of all the birds that cheer us with their presence the robin we concede holds the warmest place in our affection. Coming as he does abo

the middle of February he is the first of the song birds to return, and his merry notes proclaim him the harbinger of spring. But suddenly at this uncertain season the cold north wind that so frequently follows a sunny day, seems to freeze the very song in his throat; and in the driving snow storm he sits by choice in the bare boughs near your window as if mutely appealing for protection.

He, too, is the first bird that awakened the sympathy of our childhood. We always recall him as dear robin-redbreast, and our memory portrays him as he first fell under our pitying notice, sitting all abunch in the blinding snow, now shaking the flakes from his back and now uttering a melancholy chirp.

Though the robin lacks the symmetrical elegance of the brown thrush, there is about him an air of nobleness which we admire and a trusting friendship that wins the heart. As to color he needs no description; the dark olive-gray back and the reddish-brown front that won for him the name of red-breast are familiar to all as he is seen running along the ground or, with a burst of glad rippling notes, flying from tree to tree. At this season he is fond of company, and his social qualities bind him in small flocks; yet he is never so lost to gallantry as to stray far from the side of the female that he wooed and won with all the tenderness and passion of a true poet.

When once the weather is settled he is all gladness, and like any groom, he fairly revels in the transports of marital relations. In search of a cozy building site for their home he dotingly leads his mate from place to place as if to invite her inspection and approval of his choice, and all in that suasive manner which is charming to behold.

A crotch in the sheltering branches of a tree is his favorite selection, but it sometimes happens that a protected nook in a fence or barn attracts him. He is fond of familiar locations, and with a delicate sentiment loves his old home, building year after year in his favorite tree or 'neath the same shed's protective eaves. The nest is composed of twigs, grasses, moss and leaves, and, like the pioneer's cabin, it is chinked with clay.

The eggs are of a light bluish-green and from four to six in number. When the female takes to brooding the male bird seems at a loss. He sings and his song is sweet, but through it steals a plaintiveness like a sigh in the remembrance of happier days. Suddenly he will cease and in a restless manner fly to and fro in a vain endeavor to entice his mate to again join in those joyous rambling flights which he has not forgotten. But all to no purpose; and so, with a resignation which is crushing, he is away on a solitary forage. In his amount and selection of food he is either the vulgar gormand nor the dainty epicure. Insects and their larvae that are destructive to fruit and forest trees, the succulent earth-

worm and occasionally the small fruits form his diet. Just after a warm, gentle rain he runs along the lawns and meadows in search of one of his favorite foods. Your near presence is no embarrassment; for, upon descrying the angling-worm he pauses, with askance, as if he would say, "by your leave," ere he draws forth his wriggling prize with all the finesse of a disciple of Isaac Walton.

But every day of delight has its gloaming. In a word, his careless and joyous existence can not last forever; so when the young are hatched he is more busy than happy, for the food in those rapacious throats disappears as if by magic.

The robin, like all insect-destroying birds, in the guardian of the forest is man's benefactor; but, unfortunately, with true friends, we seldom know their worth till they are gone.

The protection of animal and vegetable life is the debt that humanity owes to nature. How lightly we regard that obligation the ruin of our forests can explain, the silence of the birds can mutely tell.

What boy has not felt a kind of instinctive enjoyment, a savage pleasure in his power to take lower life! Even years may not soften the natural harshness; but as the mold fashions the metal, so association shapes the man, and then, he who is not a friend of the birds is man's most abject foe. Long ago a friend to the feathered kind invented a beautiful fancy to protect the robin. That it was effective every boy well knows who has listened with the wildest play of imagination to the tale his mother told. In concluding, a weird prophecy ran: "Pleasure shall never attend and fortune shall never smile upon the boy who wantonly destroys the robin, and the hand that gives the fatal blow shall tremble forever and ever." Bold indeed was he whose curiosity prompted him to make a trial of the truth. And after all who can doubt the prophecy, or that the strain of sadness which trembles through the robin's song is the enchanted voice of that friend of old pleading for mercy as of yore!

But as the days roll by the robin's song draws to a close. Spring, when about to take her leave never forgets the magician's wand that she carries; and, as a touch gave, so it takes away the perfume from the blossom, the color from the petals, the song from the robin.

All through the long summer days, though he may be silent, he is not the less happy; for often there is a tranquility of the soul too deep for word or song. Mild September comes and goes; October with its fruit and frosts, then comes November, and still he lingers. But the sharp click of the falling nut, the bark of the watchful squirrel, the rustle of the brown curled leaves as they are bowled into the hollows by the wind-sprites, all are ominous sounds to the robin. The hum of insect life is heard no more. Food became scarcer and scarcer, and now at last only

the berries of the gum tree remain. Longer he dares not tarry and joins one of the many clans that wing away to the south. And so, far from home, 'neath the golden mellow light of the evening sun, thousands gather in the tall forest trees for their nightly rest. Especially in the cane brakes of Tennessee do they congregate. Once within the enemy's lines, and without a song for countersign, the watchword on every side is death; for the robin there is looked upon as a game bird. In fact, upon the tables of Europe as well as in our own South, all of the thrush family are esteemed as dainty morsels. Poor robin! No wonder he is loth to leave and impatient to return to his native North, where love and law protect him.

How we welcome him back! There is a charm about him which is never broken, for he is the herald of brighter days. And so it shall always be: the first to come and the last to leave, he will ever retain our pity, our friendship and our love.

IV. THE WOOD THRUSH—*Turdus Mustelinus*.

Is a lover of the forest and is seldom seen in cultivated localities, but toward the close of summer afternoons, he like the other thrushes, delights to sing from the high swaying boughs. His song is not often heard; but, though short, it is extremely liquid and sweet.

The young are usually four in number. The wood thrush has his summer home and his breeding place with us, and as the little ones are fed and remain after they are grown, the good that is done as forest protectors, who can tell?

The other thrushes: THE HERMIT—*Turdus Pallasi*; the OLIVE-BACKED—*Turdus Swamsoni*; WILSON'S THRUSH—*Turdus Fuscescens*, are migratory in the spring and fall and with us have no song.

The MOCKING-BIRD—*Mimus Polyglottus* is highly prized every-where as a cage bird. He is the virtuoso in all the magic of music, and he is sometimes though very rarely a summer resident in southern Ohio.

THE YOUNG ROBIN.

An Observation of Interest.

[John E. Douglass Jr.]

The old birds had built their nest in an orchard tree near the house, and were rearing their brood with the most tender care, when one of the young robins made bold to leave home and try his fortune; but like many

an older head before him he overrated his strength and made but sorry attempts at flight.

As old Tabby with her litter of kittens was prowling around for just such prey, I captured the little robin and gave him the friendly protection of a roomy cage. Under the branches of a young elm I hung his prison, with the hopes that the parent birds would supply his food; but in that I was disappointed; for, from some unknown cause they never paid him a single visit. His entire sustenance now devolved wholly upon me. For several days I fed him with bread softened with water; and upon every approach his widely distended bill gave me the broadest kind of a hint. At length he grew tired of this unvaried diet, and so I set about to supply him with a more natural food. Under an old disused haystack, where the ground was soft and moist, I deeply drove the tines of a pitchfork, and, by prying repeatedly on the handle, so as to disturb the earth, in imitation of the ground-mole, the angling worms came to the surface squirming from their windings for dear life.

In this way I was able to supply his rather exorbitant demand. Very soon however, he learned to reach forward and to take the proffered worm from my fingers, and but little later he helped himself to those deposited upon the floor of his cage. He became exceedingly friendly, and his every action expressed the gratitude I am sure he felt. His plumage grew thicker and more beautiful, and from the exceptionally brilliant red of his breast, I judged him to be a male. About this time a young red-bird also fell from his nest, and the poor little fellow was pitiable to behold, so diminutive was he and poorly feathered.

For the sake of convenience and company he was incarcerated with the robin, who at first looked upon him as an intruder, and eyed him with a curiosity not unmixed with contempt; but his better nature soon asserted itself. One morning after a few moistened crumbs had been dropped into the red-bird's throat, and the robin had been given his supply of worms, the strange actions of the latter bird prompted me to linger near the cage. The robin was all nervous agitation. He hopped toward the red-bird, which opened his mouth and fluttered his wings, as if overjoyed at some mysterious mutual agreement. Heretofore the robin had devoured the worms upon sight, perfectly regardless of their fantastic contortions as they disappeared down his throat. But now he was careful to select a single worm, and disengaging it from the ball mass into which it had entwined, he ran it back and forth crosswise between his bill; and continued to beat it upon the floor of his cage, until the worm hung as limp and lifeless as a piece of twine.

Very carefully then he carried it to a remote corner, where it was deposited; and, with the sharpest kind of inspection, he lingered only

long enough for an assurance that the worm was powerless to creep away. The others to the number of five or six were devitalized in the same manner.

All were carried to the same corner, and then, before picking them up, the robin turned to see whether his protege had forgotten the promise that had been made him. But no; for a more vigorous, spasmodic fluttering told him that the little red-bird had a memory longer than his bill. Each worm, one after the other, was seized by the middle and hung on either side of the robin's mouth like a Mongolian's moustache. I now conceived his noble design, and felt proud of him; but, notwithstanding, a shiver crept over me when I saw that the robin judged the poor little red-bird's capacity by his own, and that perhaps there would be a shadow of compulsion in a certain red-bird's never-before-known meal, which was plain enough would more than rival a modern thanksgiving dinner. The robin, elated and excited by his novel position, moved toward the red-bird and undauntedly fed, if, in not the wisest, the most paternal manner his little helpless companion. The sight filled me with wonder and admiration, and I thought what a beautiful example for humanity! If the strong would but stoop to aid the weak, what a world of happiness this earth would be. And the red-bird, poor little fellow! Replete with his exaggerated meal, he could but suffer his eyelids to fall in that dreamy, half closed manner, so suggestive of sensual satisfaction. Day after day this foster parent fed his little charge, and so nicely did he draw the line of instructive politeness, that never in a single instance did he touch a morsel of food himself, until the other's wants were supplied. Upon several occasions I must own that I felt a solicitude for the red-bird; for had the robin been so rashly kind as to have replenished his plate, as it were, that generous act I believe would have proved fatal. As it was, with a wisdom beyond his years he never mistook the signs of satiety; but seemed to enjoy a rare kind of humor in having stopped the red-bird's mouth, in more than one sense of the word.

The rest is soon told. One morning a week later the little red-bird was found dead. It was but too apparent that, as the saying goes, he was killed with kindness. As the robin was now strong enough to fly he was given his liberty, but he seemed to be lost; and, after flying a short distance he returned and sat the most of the day on the top his cage.

For weeks after he would come when called and follow along the round, apparently as much for the company as the crumbs he would receive. He remained familiar all summer, but gradually his association with other birds weaned him away.

In the fall he joined the flocks of robins that flew to the south, but the following spring he returned, and was a frequent visitor in the elm

tree where he was reared. That summer was the last that I saw of him. When spring again returned I looked for him in vain; and he probably fell a victim to some remorseless destroyer, who, in the south visits the robins' roost with a bag and a club.

THE ABSENCE OF TREES FROM PRAIRIES.

BY PROF. DANIEL VAUGHAN.

While the physical wants of a vast multitude of living beings are supplied by the bountiful hand of Nature, man alone has been permitted to study her works and to derive instruction and intellectual pleasure from her most distant realms. By the revelation of science, he is led to the contemplation of the scenes and wonders which transpire in the remote domains of celestial space, and he beholds in the crust of the earth a vivid picture of revolutions which marked the eventful periods of geological history. Even the present condition of the earth's surface may reveal more curious information respecting nature's mysterious operations and laws; while, at the same time, the knowledge we obtain of the changes going on around us may greatly assist in ministering to our bodily wants, by supplying the necessities or the superfluities of life. Of the numerous topics which physical geography presents to our consideration there are few that can be studied with more profit, than the health of trees in different localities, and their total absence from many vast plains of very considerable fertility.

The capability of all lands for supporting animal and vegetable life depends, in a great measure, on the rains they receive; and by a very admirable contrivance of nature the atmosphere is enabled to dispense bountiful supplies of water to most parts of the habitable globe. By the influence of solar heat water is incessantly converted into vapor, and rises from the ocean to the higher regions of the atmosphere; by the motion of the air it is transported to distant regions, and the wind furnishes a means of carrying on, not only the commerce of art, but the far more extensive and important commerce of nature. It is not to be expected however, that all lands should receive an equal portion of the stores of water that float around the earth, for though very large, the supply is frequently exhausted before reaching the interior of continents. Accordingly more rains fall in islands and maritime districts than in places remote from the sea, and the amount is much greater near the equator.

than in high latitudes. We may ascribe the sterility of the deserts, which occupy the central portions of this continent and of Asia, to their great distance from the sea, and to the position of mountain ranges which intercept the supplies of aqueous vapor conveyed by the winds from the great oceanic reservoir.

It appears from meteorological observations that high mountains increase considerably the fall of rain in their immediate vicinity, and cause it to descend in more frequent and seasonable showers. The effects of these pinnacles of nature can not be accounted for by the mere reduction of temperature which they occasion, and it would seem that part of their meteoric action arises from their discharging the upper atmosphere of electricity. In extensive plains the lower stratum of dry and dense air serves as an insulator between the earth and the higher atmospheric regions; electricity, accordingly, becomes more intense at great elevations, and is discharged only when the air is saturated with moisture. The discharge seems to be the means of condensing and precipitating to the earth much of the aqueous vapor, as heavy rains and hail-storms are the invariable associates of thunder and lightning on an extensive scale. Prof. Hare ascribes this effect to an indirect influence of electric actions. As the air parts with its superfluous electricity, it is repelled from the earth; in ascending it is released from a considerable pressure and expands; cold is the result of this expansion; the reduction of temperature which takes place causes the vapor dissolved in the atmosphere to return to a liquid, or often to a solid form, and heavy rains or hail-storms are the consequence. As the lower atmospheric stratum is moistened by the descending drops, the escape of electricity is facilitated, and the rain continues until the air is deprived of a vast amount of vapor it previously contained, and brought into an electrical condition more favorable to a state of repose.

In an article published in the *Journal of Man* for February, 1853, I advanced similar views, and supposed them to be original; but I subsequently found that the same doctrines had been broached by Dr. Hare some years before. The ascent of air during heavy rains, is also maintained by Professor Espy, but is ascribed by him to the heat produced by the condensing vapor. It must, indeed, be admitted that the heat arising from this cause may co-operate with electricity in disturbing the repose of our aerial ocean; and it seems extremely difficult to decide, with any degree of precision, the part which both agencies perform in meteoric phenomena. But independent of any theoretical deductions, all the results of observation and experience disclose the very remarkable peculiarity in the fall of rains, as determined by the physical features of the earth's sur-

face. In very extensive plains, rains are withheld for a long time, but when permitted to occur, they are always very violent, and the land is inundated with a deluge of water. In mountainous regions, rains are much more frequent but not so extensive; indeed, the districts occupied by the Andes receive their supplies of water, not in heavy showers, but in mists of several weeks continuance.

The green vesture of vegetable forms which adorn the surface of our planet, assumes peculiarities dependent on the meteoric influences which operate upon them, and every climate has the kind of plants adapted to the physical conditions it presents for their support. As the total absence of rain excludes all plants from deserts, it would be reasonable to expect that the vegetation on extensive plains should acquire a peculiar character, in consequence of the occasional prevalence of long drouths and excessive rains. Plants, like animals, are often the victims of disease, and my present object is to show that the unfavorable conditions to which trees are exposed on vast plains will be productive of so much disease and degeneracy, as frequently to cause them to disappear entirely from the soil.

Though much obscurity still hangs over several vital operations, the chief points connected with the growth of trees can be determined with considerable certainty. The vital fluid essential to vegetation, and corresponding to the blood of animals, is called the sap, and this rises along the woody part of the tree from the roots to the leaves, and returns along the bark and the space which separates it from the wood. By this circulation, nutritive matter is conveyed from the soil to every portion of the vegetable fabric; and it is gradually converted into wood, forming, in exogenous trees, a new layer every year; and increasing the density of the wood of an earlier origin. We may, accordingly, ascertain the age of a tree by counting the number of annual circles, each of which represents the growth of a single year. These remarks are only intended to apply to the trees of temperate climates; since, of those growing between the tropics, many have endogenous stems, in the interior of which the woody tissue is deposited, and on this account their age can not be determined with the same facility.

The causes which contribute to change the soluble organic matter which the soil supplies into wood, deserve special consideration. Though the leaves are concerned in producing this change, it is evident that the woody matter must be formed where it is deposited, and in this place access is denied to the solar light, which is capable of exerting a considerable influence on several kinds of chemical and vital operations. But appears, from the discoveries of modern times, that electricity serves as very important instrument for performing chemical action, and for transmitting chemical power. I have, therefore, been led to conclude that th

elaboration of the sap depends not only on solar light but on the evaporation from the leaves; and that this gives rise to an electric excitement which extends to all parts of the plants and serves to consolidate the organic materials which the sap holds in solution.

This theory was first announced in two essays which I published in 1848, and my researches and observations since that time have shown that it is confirmed by numerous facts, of which I can here only notice a few. The change which evaporation from the leaves produces on the sap of trees may be traced with great precision. Before their leaves are developed, the sap of the maple and hickory affords sugar, while that of the peach, plum and cherry trees, chiefly consists of a solution of gum. But as soon as the leaves are formed, the sugar, gum, and other soluble matter comprising vegetable juices slowly change into wood. If a tree be deprived of its foliage during summer, or if a long continuance of dry weather causes evaporation to be interrupted, the formation of wood will be arrested and the sap will return to its condition during winter and spring. After a long absence of rain, the exudation of gum from cherry trees takes place in the most copious quantities; and climates where such drouths are common, always furnish the most copious supplies of this article. The exudation of gum is also caused by over-pruning peach and cherry trees; as a small amount of foliage is adequate to the production of wood, only when rains are frequent, and evaporation subject to no long interruption. The juice of the Maguey plant, which grows in warm climates, undergoes fermentation if collected before the leaves grow, and is used by the Mexicans as a palatable beverage. Its character is, however, altered on the formation of leaves, and to render it fermentable during summer it is necessary to deprive the tree of its leaves several times. This course is often pursued, though it is found to cause the death of the plant in one or two years.

The most hardy members of the forest might be destroyed by a similar removal of their foliage. Even the health of every tree is impaired, and its age is shortened by every interruption which the elaboration of the sap experiences, either from excessive pruning or from a long absence of rain. The durability of wood depends, in a great measure, on the evaporation which takes places from the foliage of the living plant; and when the lignifying process has been imperfectly carried on the tendency of decay will be unusually great. Now the decomposition of vegetable matter, like many diseases of animals, is contagious; and an imperfectly elaborated layer of wood produced during a dry season will not only decay prematurely itself, but will cause all contiguous parts of the tree to undergo a similar change, and thus destroy the work of a century. It is somewhat different with the herbaceous plants which are renewed every

season. The evils which they experience from a long drouth are confined to the season in which it occurs; and these transitory occupants of the soil feel none of the calamities which a dry season may have inflicted on their predecessors.

An examination of the several instances of extraordinary longevity in trees, will show how much the health and durability of their wood is promoted by the frequent rains. They always attain the greatest age in islands, in maritime districts, or in the vicinity of high mountains; and in a word, in all regions where rains are of frequent occurrence and long drouths rarely interrupt the elaboration of the sap. The oldest monuments of the vegetable kingdom now living in the old world are to be found in Great Britain, in the Island of Teneriffe, in Sicily, on the coast of Africa, and on the highlands near the Syrian coast. The cedars of Lebanon are said to have stood since the Christian era, and many of the oaks and yew trees of England are said to have attained an equally advanced age. A dragon tree in the Island of Teneriffe, and the celebrated horse chestnut on Mount Etna, present still greater examples of longevity, especially the latter, which is said to measure one hundred and eighty feet in circumference at the base. It is said that this tree consists of five trunks; but, even on this supposition, it must have required over thirty or forty centuries to attain its present gigantic dimensions.

The age of a tree growing near the mouth of the river Senegal, in Africa, has been estimated at over five thousand years.

India is equally celebrated for the frequency of its rains and the venerable age of several of its trees. It is said that the banyan tree which sheltered the soldiers of Alexander, is still living! Among the venerable giants of the New World, the cypress of Oanica and that of Chepultepec, are the most celebrated, and California has produced many trees which rival them in age.

[The following brief article which I clip from *Popular Gardening* of June, 1889, evidences Prof. Vaughan's statements.—A. L.]:

SOME GIANT TREES OF AMERICA.

W. A. ENGARDE, PHILADELPHIA, PA.

Information relative to the forestry of the world, and particularly that concerning the woodland giants of this country, will always prove valuable and interesting reading to those interested in facts associated with the wonders of the vegetable kingdom.

Among the conspicuous representatives of American trees is the celebrated Northbrook chestnut tree, which grows in Chester County, Pennsylvania. It is eight feet in diameter, and is still green, vigorous, and thus in distinguished contrast with the famous, but somewhat smaller, chestnut trees at Cedar Croft, in the same county. Recently an illustration has been given of the monstrous chestnut on Mount Etna, which is sixty feet around. This venerable monster is now reduced to a mere shell, but in days of yore was the scene of many important gatherings of royalty.

Many magnificent and colossal white oak trees are growing in different parts of the United States. Prominent among these are three: first, that at Mantua, Monmouth County, New Jersey, which is more than six feet through; second, that at Berkeley, in the same State, which is about eight feet through; and lastly, the mammoth tree known as the "Preaching Oak," which stands near the James river, back of Harrison's Landing, Virginia.

The large cypresses in Burtram's garden, Philadelphia, as well as the large ones that grow in the swamps of the Pearl river, are notable trees. The famous Montezuma or Coatez cypress, now in the last stage of decay, illustrates the size, age and whole character of the largest of the Mexican cypresses. This tree is rich in historical associations. It was standing at the period of the Conquest of Mexico, and near it some of the most tragic events of that great struggle occurred.

The old Monterey cypress, in California, is probably one of the oldest trees in North America, and stands among the naked granite rocks like a sentinel watching the advancing waves of the Pacific ocean.

But it is the forest of Guiana, situated in the zone of almost constant rains, that affords the greatest number of these patriarchs of the vegetable kingdom, notwithstanding the influence of a warm climate in promoting decay.

Lands which are subject to long droughts, either in consequence of their distance from the sea, and absence of mountains, or other causes, afford no examples of great aboreal longevity. European Russia is a vast plain, not materially differing from the western prairies, and like them it occasionally suffers much from a long continuance of dry weather. This condition of things affects, in a very conspicuous manner, the duration of vegetable life, notwithstanding the vast extent of the Russian forests, they contain no very old trees except in the neighborhood of the Baltic and Black Seas, and in all other places the timber they furnish is very defective in durability. The dry rot prematurely attacks nearly all the Russian ships, permitting few of them to last longer than ten or twelve years, and their great liability to decay is a very serious drawback to the naval power of this extensive empire. Even on this continent the timber of the Atlantic coast is much more durable than that of the Mississippi Valley, and the number of hollow trees appear to increase as we retire from the sea-board.

As the same state of things is productive of degeneracy as well as disease, it would be reasonable to expect, that it should frequently cause trees to disappear from the soil remote from the ocean. This would be most likely to occur when the soils have great fertility; for in this case they supply more nutriment to trees than can be converted into wood by the action of the leaves. Accordingly extensive plains in the interior of continents should, in course of time, become destitute of woods except in places where the soil is comparatively barren, or along the banks of rivers, where they are favored by mists or heavy dews. Such peculiari-

ties are to be witnessed in the western prairies of this continent, the pampas of South America, and the steppes of Central Asia. Whenever meteoric influences are favorable to their health, trees have the advantage over annual plants in disputing the possession of the soil, and there the forest acquires an extensive dominion over the land; but the case is reversed on extensive plains, and here the herbaceous plants are successful in resisting the encroachments of the forest.

It has been generally supposed that the absence of trees in these localities is due to human agency; that the prairies were once cleared and cultivated, and that the growth of the forest was subsequently prevented by fires. But the western prairies afford no monuments of the skill of an agricultural people of former times, while the extensive pampas of South America were, according to Humboldt, always avoided by the Indians, and contain not a single vestige of ancient civilization. The steppes of Central Asia are likewise destitute of wood, though the forest has established its domain along the coast and around the mountains of that continent. It may, indeed, be possible to convert prairies into woodland by selecting hardy plants, by placing them at sufficient intervals to permit the expansion of their foliage, and by always introducing seeds from other regions to compensate for the effects of local degeneracy; but it is doubtful whether all these precautions will enable the wood to attain a proper degree of strength and durability to supply those localities with timber.

From the present theory of the action of the leaves it might be naturally expected that precisely the same consequences should result from a diminution of foliage as from long intermissions of rain. This seems also confirmed by the result of observation. According to Landon the durable character of wood is much impaired by pruning, and long experience has shown the propriety of discontinuing the practice in Great Britain. Indeed the premature decay of fruit trees generally results from over-pruning, and the effects of a dry season will always operate most injuriously on those trees which have been deprived of too much foliage.

And yet pruning is not without its advantages. The vegetable extract of the sap is not changed into wood, though contributing much to the premature decline of the tree, is yet the proper nutriment for blossoms and for fruit. Indeed, many trees fail to produce fruit unless they are pruned or stimulated by rich manures. Where rains are frequent, and accordingly where the tendency to form wood is great, pruning becomes more necessary; but it should be carried on with much caution, or entirely omitted in continental climates where long drouths are of frequent occurrence. In the dry summer of 1854, it was generally remarked

that those grape vines which were not pruned, produced abundantly; and an important fact recently communicated to me will throw much light on the subject. In a vineyard situated about two miles from New Richmond, Ohio, there were a few grape vines which were never pruned, and they remained wholly unproductive for several years, while all the rest bore luxuriant crops. But during the dry season alluded to (1854),—the case was reversed—the unpruned vines bore for the first time an unusually large number of grapes; while the crop on the rest of the vines was extremely small. Several other facts may be adduced to prove the theory here stated respecting the agency of leaves in the formation of wood, and the necessity of rains to render their action effective.

NOTES REGARDING THE PRECEDING PAPER.

In February, 1879, Prof. Daniel Vaughan, the author, during a visit at my home, while speaking about trees, mentioned that in either the years of 1855, 1856 or 1857, he had published a paper on *The Absence of Trees from Prairies*, but that he had forgotten in which journal it had appeared, and that he, considering it as one of his best efforts, had tried to ascertain where it was published, for the purpose of republishing it. He then communicated to me the line of arguments.

On April 6, 1879—less than eight weeks after the related occurrence—he died in Cincinnati. All attempts on my part to find the paper failed, until lately, when in search for information on another subject, I came across the paper in *Vol. I of the Cincinnatus*.

The paper is one of exceedingly great interest, not only to the forester, but to every student of nature.

ADOLPH LEVÉ.

FORESTRY:

AS RELATED TO THE GENERAL GOVERNMENT AND TO THAT OF STATES.

BY DR. N. E. JONES, CIRCLEVILLE, O.

[Read before the Cincinnati Society of Natural History, October 1, 1889]

It has been truthfully stated—it has for thousands of years undergone practical demonstration, that forests determine the climatic conditions of any given country. And for this reason forests form an indispensable basis for agriculture, manufacture and commercial industry. They also bear a near relation to the health, wealth and prosperity of a nation.

These facts being so universally admitted, it may seem strange that a government which has from its inception been so interested in the welfare of its subjects, and which has assisted and encouraged in various ways so many sources of wealth and industry, should have overlooked the forests, from which the nation is drawing larger amounts of wealth than from all other sources combined.

The government has ever been devoted to the interests of agriculture and manufacturing; and by premiums, by exemptions, by protections, by model farms, by grants, by bounties, by patent rights, by technical schools, and by the introduction of superior animals and improved machinery, has fostered well these industries. The government has not been at fault either, in donating large sums in the construction of canals and railroads, and for the improvement of rivers and harbors. It has even taken an interest in the clam and oyster, and stocked the rivers and lakes with young fish, that the devastation of these natural sources of wealth may be compensated thereby and perpetuated as a national trust; while the springs, and brooks and streams—the climatic causes of disease—the necessary conditions for national wealth and national health—in a word, the importance of forests for the *nation*, for the land, for agriculture, for the perpetuation of rivers, has received no official recognition.

But for all this the subject is of national interest, and calls for its share of official attention. Few are so blind that they can not see that the fires and thieves, and increasing consumption, if continued, can not fail to make this a treeless waste, a desolate and uninhabitable country.

Procrastination is the thief of time. The general government should no longer postpone a definition of its policy regarding forests, rivers, and its millions of acres of arid lands. The American people have been slow to realize the drifting of this country towards a forest famine and its destructive results. It may be said, "In a republican government it is not good policy for legislation to go far in advance of public sentiment." And on the subject of forestry the people have been politically dumb; and no doubt would have remained so for a much longer period, had it not been for the inspiration of Governor Morton. One cold day in January, 1872, he presented a resolution before the Agricultural Society of Nebraska to set apart one day in each year and consecrate it to planting trees. This day was christened Arbor Day, and now by law and proclamation in thirty-one States has entered our schools and colleges, and forestry forms part of the curriculum.

Wherever Arbor Day has been observed, it has awokened a sense of inquiry—has taught the children the names, nature and usefulness of trees, with a lasting admiration and love for them. The older people, too, have received an important lesson, how to use, and yet preserve their forests.

True, Arbor Day has done but little to compensate for the ten million acres of natural forests that are destroyed each year. But was it John Brown's pikes, at Harper's Ferry, that caused a bloodless emancipation? The solution of every great problem has its beginnings in peripheral strokes. The first demonstration may appear child-like or impracticable. Still, if not the steps of logic, they are no less those of inspiration, which has governed and must govern the world.

And now Nebraska, with her million acres of planted forests, has made each tree a living oracle of the Gods; and Minnesota, Kansas, Iowa, Wisconsin, and other western States, are close upon her in the right road. With laws and plantings and premiums; with schools and colleges; with the hearts and workers in it; forestry has built up a healthy public sentiment that must be felt. The eastern States are also glistening with law officers to protect their woods from fires and thieves; and by large premiums and exemptions from taxation, have greatly promoted the interest of forestry in their respective States.

Even the State that sold her birth-right—one hundred and fifty billion feet of forest for nine hundred million dollars, is not without influence for good. But what shall we say more? Others, with these, have stained a good report, and through the schooling of "Arbor Days," have wakened a public sentiment that is marching rapidly toward the throne, and the greatest nation will speak; when that voice reaches the general gov-

ernment it will be magnified in tones of thunder, for the people are waiting at the foot of the mountains for their Moses to come down.

All these little acts of the States and of the people are of much more importance than they seem. They are still small voices that can be heard afar, for the government of the nation is not deaf to the will of the people, and is by this will ready to take the front in every good work and in every thing profitable. And in this direction it certainly would be an enterprising and profitable act on the part of the general government to withdraw from sale or entry for one hundred years, if not perpetually, all remaining forests and all arid lands, or where the annual rainfall is below twenty inches; and place the same under the management of the secretary of agriculture, with ample powers and appropriations to build up a grand system of Forestry, surpassing in extent and wealth combined, all those of the kings, emperors and lords of Europe. For timber wood has something besides the climatic influences it yields. It is wealth that becomes a never failing source of revenue. It certainly would be sound policy for the government to make liberal appropriations as investments for the benefits that may be received in future forest returns.

No one can deny that something must be done; for the destruction of timber will go on increasing with the lapse of years, until the whole country is depleted of its woodlands, and rendered hopelessly barren and sterile. The interest to the nation is too important to permit the government any longer to pass by on either side in silence.

Statistics show that the annual forest crop of the United States exceeds seven hundred million dollars in value; which is more than the yield of all the gold and silver mines, coal, iron, copper, lead and zinc combined, and if we add to these the value of all the steam boats, sailing vessels, canal boats, flat boats and barges in American waters, the sum would be still less than the value of the forest crop by an amount sufficient to purchase, at cost of construction, all the canals, all the telegraph and telephone lines in the United States. This sum of seven hundred million dollars exceeds the gross income of all the railroads and transportation companies in the United States. It is an interest ranking first in importance, even in dollars and cents; and certainly, if for no other reason than the wealth there is in it, the subject demands the attention of the government sufficient to enforce protection, preservation, and perpetuation.

At the present time little or nothing is done to protect and preserve the remaining forests of the public domain. All existing laws are mockeries to the frauds, thefts and fires that are annually destroying more than one hundred million dollars' worth of this national wealth. The loss by fire alone in 1880 amounted to over twenty-five million dollars.

The amount stolen annually in California, Oregon, Nevada and Washington can not be estimated.

A fraction of the twenty-five agents the government has attempted to spread over four million square miles to catch the thieves, put out the fires and act as government witnesses. A few of these faithful agents followed some of the organized bandits, and counted stumps until the value of the lumber taken amounted to thirty-six million dollars; and which represented, perhaps, only a small part of the total amount stolen by these and other gangs during the period named.

Thus, with an appropriation for protection and other purposes of seventy-five thousand dollars, and limited amount of agents, the government has been sleeping quietly, while fraud, robbery and fire have been sweeping down the national wealth before the very eyes of the feeble and inefficient authorities. The recent fire in Montana is reported as having consumed an area of timber of one hundred square miles, worth millions of dollars. And from the Cincinnati Enquirer as late as last Saturday, September 28, 1889, we clipped the following: "Once more the forests of the far west are fiercely aflame. The annual loss from these conflagrations is too vast for figures to represent. It is a loss not in money only, but it ruins whole sections of country beyond the power of generations to repair. And yet there is no visible remedy."

"And yet," says the influential and progressive paper, "there is no visible remedy." There is a visible remedy. Let the people demand it now.

It may seem expensive to maintain an army of officers and employes to protect and perpetuate the forests of the public domain. But this great army would not be idlers. And notwithstanding it would require large appropriations, it would repay the outlay many thousand times in national wealth and national health. Nothing short of an organized department of forestry can protect and perpetuate this source of national wealth. The appropriation for this department in France is five million dollars, and is returned with good interest. Austria not larger in extent of territory than the states of Illinois and Iowa combined, maintains thirty-two thousand forestry officers, and receives a large net income from this source.

And reports show that Germany has an annual income of fifty-seven million dollars from her area of thirty-three million acres of timber. And it is estimated that no more is harvested each year than is compensated by growth and re-occupation of wasted ground.

For forest preservation does not mean that trees shall not be cut down; but that they shall be used, while all the conditions for their reproduction are steadily maintained from year to year. Consequently forest preservation means protecting, and using if necessary, an amount

equal to the production by growth. This requires planting, and tree-planting and forestry means labor in this country as it does in Europe. The United States without Alaska is, I believe, nineteen times larger in area than Germany. Therefore to be proportionately equal with this foreign power, we should have under control of the government an area of seven hundred million acres, as a reservation for timber to supply the public necessities of the near future.

According to geological and geographical surveys, we have six hundred and fifty million acres of arid treeless land, incapable of successful cultivation without irrigation (but where trees will grow; for experiments have shown that trees will grow where the rainfall is insufficient to insure crops of grain and grass). This arid tract of our public domain should at once be made a field of labor with government pay. It should be dedicated forever to the cultivation of timber. First along the water-courses, and most favorable positions, and eventually through and over the more arid wastes, until the nation is made rich in the act.

The great railroad companies, also, should not delay in setting apart at least one million acres of their lands for "God's first temples."

And here the labor question comes to the surface. For every government that is able to sustain itself, must have something for idle hands to do. The increasing supply of labor in this country has already alarmed many thinking people—how all can find employment, which means bread. So much so, that it has been suggested that the government construct a ship canal from the Atlantic to the Mississippi river, as a mere safety valve—to do it for the labor or bread that would be in it. But here is something better—a necessity. A necessity that can relieve the groaning treasury of its remaining surplus, and give employment to a vastly greater number of persons. For the labors of forestry are as immense as they are indispensable; and can end only with the end of the race. A forest of six hundred million acres, thoroughly organized and officered under the secretary of agriculture, would sink a postoffice department and its patronage into insignificance, and would be the brightest star in the political solar system to those who are applicants for place. But this is not all—it would reclaim the arid lands, make others more fertile, the climate more healthy, the rainfall more regular and abundant; and in due time would become the incalculable wealth of the nation.

The immensity of the consumption of forest-products can not be measured accurately; but we can form some idea of its vastness when it is known that the one hundred and eighty-seven thousand miles of railroads and one hundred and thirty-seven thousand miles of telegraph lines in this country consume each year the annual growth of a forest equal to one hundred and fifty million acres.

Nothing short of a large area of well managed forests will prove adequate to future demands. The government of the United States has the nucleus in her natural forests for this undertaking now; has the land for more now; has the money now. And capable men to do the work will not be found wanting.

In 1855, J. J. Stevens, Governor of Washington, in his final report of surveys for a railroad across the Rocky mountains, called the attention of the government to the arid lands west of the Missouri river, between 40 and 49 north latitude. He compared it in extent, climate, rainfall and other features to the steppes, which occupies about one-fifth of the Russian empire in Europe, and quotes the "Commentaries of the Productive Forces of Russia," to sustain his statements. And we here select from these quotations to show there has been advancement even in Russia on the question of forestry. The selections to which I wish to call your attention are as follows: "Amongst other peculiarities of the steppes, a very prominent and distinctive one is the absence of timber. * * * * * And opinions differ greatly as to the possibility of wooding it anew." Since 1855, the Russian government has not only settled their opinions, but has adopted a policy of reforesting these two hundred and forty thousand square miles worthy of imitation.

Let our government do as Russia is doing, and the steppes from the Missouri river to the Rocky mountains will soon be reclaimed and made to "blossom as a rose." And it is cheering to know that during the last Congress, Senator Sherman introduced a bill entitled: "A bill for the preservation of the woods and forests of the national domain, adjacent to the sources of the navigable rivers and the affluents in the United States."

This proposed bill withdraws from sale and entry all timbered lands adjacent to the navigable rivers and their affluents. It also provides for the planting of trees along the course of said rivers where the land is timberless, so that the rivers may be kept in a navigable condition by promoting a continuous supply from their sources and affluents. Also to cultivate forests on the military and Indian reservations. Stating the fact, it is "universally known that the destruction of woods causes all countries to become arid and unprofitable deserts."

This authorizes a commission for the examination of forests, planting of trees, fixing boundaries to reservations, etc. The appropriation for all his named in the bill is twenty five thousand dollars, when it should be at less than two hundred and fifty million dollars annually. Just think of it—twenty-five thousand dollars appropriated to preserve the woods and forests adjacent to the sources of the navigable rivers and their affluents, plant trees along the course of said rivers, and to cultivate forests on the military reservations and Indian territories—twenty-five thousand

dollars. Although the bill looks more like an anodyne to soothe the clamoring of politics than an honest intention to do something, it must be remembered that this is the first attempt to legislate on the subject, and may terminate in a fruitful ending.

It is certainly the duty of every government to embrace the present, to confer benefits upon its subjects, when it can not be done in the future. This nation will need oaks and pines, hard woods and soft woods, five hundred years hence as they need them now. But trees can not be produced at will; they require time. And, if history is worth reading, if political economy is worthy of study, if past experience is not a fraud, the government should not delay in marking out a policy deserving the nation, in regard to the forests and forest supplies of the United States. It can not begin too soon to anticipate the necessities of the people and generations that are to come after.

Independent upon the lumber supply, experience agrees with science, that forests should bear a certain ratio to other lands in order to make a country productive as well as *healthful*. Even if all the lands are good for agricultural purposes it would be the greatest folly to clear off all the woodland; as such policy would not fail to result in diminished crops, impaired sanitary conditions and common ruin.

This may not be believed by some, for we are all alike disposed to take the infidelity side of questions involving Providence or nature's irrevocable laws. Even a Brooklyn divine recently made the statement, "that lands watered by the ingenuity of man are *five times* more productive than those watered by heavenly showers; and that in twenty-five years there will not be between the Atlantic and Pacific coasts one hundred miles of land not claimed either by the plow or pick, and the great waste given up to the rattlesnake, bat and prairie dog will, by irrigation, be made to support whole nations of industrious population." While the chief of the geographical survey states of the arid lands in the Dakotas, Montana, Washington Territory, Oregon, Idaho, Utah, Nevada, California, New Mexico, Texas, Indian Territory, Kansas, Colorado, Wyoming and Nebraska, about one hundred million acres can be irrigated and made productive. What is to be done with the remaining five hundred and fifty million acres?

When we recount the miseries and misfortunes of the eight hundred million people that meagerly subsist on the products of irrigated, treeless lands, it is to be hoped no part of this country may ever become a Spain, a China, an India or an Egypt.

Every State and every country should have a fair proportion of the total area in timber—it is better than to have it all clothed with flocks,

or covered with corn—in it is the necessity for civilization and the basis for a happy and powerful people.

Our own State of Ohio, which has the finest agricultural climate in the world, will soon be obliged to do something to offset the destruction that is going on with her little groves. When Ohio came into the Union with forty-one thousand square miles of territory, she presented the grandest unbroken forest ever beheld on this continent. A forest interspersed with hills and valleys, springs, brooks and rivers, with a soil most inviting to the aspirations of the agriculturist. The natural conditions of things were such that the possessors of this inheritance longed for the soil, and looked upon trees with less favor than they did upon those who disputed their titles with the tomahawk. Indians could not be made to move away; but the trees were all disposed to stand their ground and take the consequences. Both were considered obstructions to civilization, and both in the contest got the worst of it.

The superabundance of trees was incompatible with the interest of husbandry, and the settlers were obliged to clear the land to till the soil. Forests can flourish independent of agriculture, but agriculture can not prosper without forests. This was not so visible, however, to the early inhabitants who lived in perpetual shade. War was declared. Every owner and occupant of the soil combined with his neighbors in the warfare of destruction; and millions of noble trees were killed by cutting a circle around the trunk, and then left to decay. Sections of timber served in this way were called "deadnings." These deadnings were to be seen all over the country as fast and as far as settlements were made or contemplated. And now—less than one hundred years—more than seventy-five per cent.* of this great forest has disappeared, and only small clumps in agricultural sections can be found in any part of the State. The announcement that the members of the Ohio State Forestry Association found a forest at Rushville with an area of eleven hundred acres, has been received with surprise.

The older trees that occupied their places in these remaining clumps have nearly all fallen by the hand of the axeman, and the younger growths are appropriated for various purposes greatly in advance of any possible reproduction of the remaining stock; and the time is not far distant, if things go on as they have been, when the salubrious climate, with summer showers and productive soil, will be changed into one of uncertainty. We are now on the very border of that limit; † still the thousands of port-

*According to the statistics of Ohio for 1888 only 15.13 per cent. of the superficial area of the state is in forest.—Rem. of A. L.

†We have overstepped it! Compare II Annual Rep. O. S. F. B., p. 70.—A. L.

able saw-mills are destroying all the remaining trees that will make boards, railroad ties or lumber. And Ohio will discover, when too late, that *private interest is insufficient to protect forest lands, and that the State must do something as well as the General Government.*

It cost France thirty million dollars to correct the evil caused by this neglect. Laws can be made and enforced to secure enough woods or timber to maintain our present climatic influences, and thus secure to agriculture that which the present greed of the landholders is making little or no attempt to preserve.

A number of years ago the Legislature passed a law, now in force, which lost the State many millions of growing forest-trees that stood on public grounds. The act reads: "Supervisors shall cut down *all bushes* growing within any county or township highway, the same to be done within the months of July and August of each year," under severe penalties for negligence or failure to perform the act.

Thus a clean sweep was made of every tree and plant, as the word "*bu-hes*" was legally and correctly defined to mean places "abounding in *trees* or *shrubs*. Trees of all kinds and sizes bordering the highways met their doom under this act. And every growing scion that dared since to raise its head along the borders of Ohio roads, has met a similar fate in the months of July and August each year. If laws can be enforced to cut down trees along the public highways, laws can be made and enforced to restore them.

There are in the State approximately seventeen thousand six hundred miles of county and township roads. A tree at the distance of thirty feet on either side of these roads would amount to over six hundred million trees—trees that could be owned, cultivated and protected by law, and in the aggregate, would form a forest equal to one hundred and fifty thousand acres.

At the same time a legal act of this kind would maintain the lawful width of roads, and prevent encroachment by adjoining landowners, and make all our highways and byways avenues of beauty, health and pleasure. A fraction of a mill added to the tax assessment in each county as a forestry fund, and expended in planting trees along the highways, would soon accomplish the work. This with trees similarly arranged along all the railroads, and a law placing twelve or more around each school-house, and an act preventing the cutting of "*bu-hes*" or *trees* growing along canals and rivers, and the exemption* from taxation of lands devoted exclusively to woods, would in the aggregate, form an important factor in preserving the true ratio of timber to farming lands, the humidity of the atmos-

*A law to exempt artificial forests from taxation would have been enacted in 1888, had it not been for the fact that such a law would be unconstitutional.—A. L.

phere, and the healthful condition of the country. This should be the duty of States, but forest supplies must come from a national source, and the American people must look to the general government, which controls the national domain, *holds the key to the vaults of the public treasury, and is responsible for this source of national wealth. To destroy the forests of the country is to subjugate the people or nation to which they belong. And if this land of the free and the home of the brave ever becomes a Dalmatia or Istra, changed from a healthful, fruitful and salubrious climate to a sterile, sickly waste, with decayed cities and crumbling greatness, the plains and valleys populated by meagre sheep and goats, and equally meagre owners, history can not say the "Romans did it."

Man, beasts and birds love trees. Every nation, every country, every town, in every age, has its historic trees. They are not without influence on the destiny of individuals, societies and nations. They are objects of reverence, works of time, homes of generations, and manifest wisdom of creation.

In them is seen the perfection of a wondrous living principle. A perpetuity exceeding all other forms of life. Beginning in the morning of creation and ending only with the end. Ever growing, growing, ever converting the inorganic world in another and higher kingdom—building—building for hundreds and thousands of years, they stand before us the unfinished monuments of time.

"The century-living crow,
Whose birth was in the tops, grew old and died
Among their branches, till at last they stood,
As now they stand, mossy, and tall, and dark,
Fit shrine for humble worshipper to hold
Communion with his Maker."

SUCCESSION OF FOREST-GROWTH.

BY ROBERT DOUGLAS, WAUKEGAN, ILL.

[A Paper read before the Nurserymen's Convention at Chicago, Ill., 1889.]

It is the prevailing and almost universal belief that when native forests are destroyed they will be replaced by other kinds, for the simple reason that the soil has been impoverished of the constituents required for the growth of that particular tree, or trees.

*There are, however, in every State lands unfit for any thing but forest-culture and these should be devoted to the production of timber, or forest supplies.—A. L.

This I believe to be one of the fallacies handed down from past ages, taken for granted and never questioned.

Nowhere does the English oak grow better than where it grew when William the Conqueror found it at the time he invaded Britain. Where do we find the white pine growing better than in parts of New England, where this tree has grown from time immemorial?

Where can you find young redwoods growing more thrifitly than among their giant ancestors, nearly or quite as old as the Christian era?

Then one may ask the question, why have any succession of forest growths? I simply answer, because you can not make something out of nothing.

Wherever we see a forest-tree growing, there our common sense teaches us that a seed has been deposited from which this tree has grown.

When a pine forest is burned over, both trees and seeds have been destroyed, and as the burned trees can not sprout from the stump like oaks and many other trees, the land is left in a condition well suited for the germination of tree seeds, but there are no seeds to germinate. It is an open field for pioneers to enter, and the seeds which arrive there first have the right of possession.

The aspen poplar (*populus tremuloides*) has the advantage over all other trees. It is a native of all our northern forests from the Atlantic to the Pacific. Even fires can not eradicate it, as it grows in moist as well as dry places and sprouts from any part of the root. It is a short-lived tree, consequently it seeds when quite young, seeds abundantly; the seeds are light, almost infinitesimal, and are carried on wings of down. It ripens its seeds in spring; they are carried to great distances, and at the very time when the ground is in the very best condition. Even on the dry mountain sides in Colorado the snows are just melting, keeping the ground moist.

The seeds of this tree would require the greatest skill of the nurseryman, and very doubtful if he would succeed at all. The burnt land is its paradise; wherever you see this tree on high, dry land, you may rest assured that a fire has been there. On land slides you will not find its seeds germinating, although they have been deposited there equally with the burned land.

Next to the aspens and poplars comes the canoe birch, and further north the yellow birch, and such kinds as can have the seeds deposited

I have seen acorns and nuts germinating in clusters on burned land in a few instances; they had evidently been buried there by animals, and had escaped the fires.

I have seen the red cherry (*Prunus Pennsylvanicum*), coming up ...

great quantities, which might never have germinated, had not the fire destroyed the debris which covered them too deeply.

A careful examination around the margin of a burned forest, will show trees of the surrounding kinds working in again, thus by the time the short-lived aspens (and they are very short-lived on high lands) have made a covering on the burnt land, the surrounding kinds will be found re-established on the new forest. The seeds of the conifers carried in by the winds, nuts and acorns by the squirrels, the berries by the birds, the mixture varying more or less from the kinds which grew there before the fire.

It is an easy matter to find out the number of years since the fire by counting the annual growth on the scarred trees around the margin of the burnt district. A fire of twenty years ago will show plainly on the pines and many other kinds.

It is wonderful to notice how far seeds of berries are carried by the birds. The wax wings and cedar birds carry seeds of our tartarian honeysuckles, purple barberries, and many other kinds four miles distant, where we see them springing up near the lake shore, where these birds fly in flocks to feed on the juniper berries. It seems to be the same everywhere. I found European mountain ash trees last summer in a forest of New Hampshire, the seeds of which must have been carried two miles as the crow flies.

While this alternation has been going on in the east, and may have been going on for thousands of years, the Rocky Mountain district is not so fortunate.

When a forest is burned down in that dry region, it is doubtful if coniferous trees will ever grow again, except in some localities specially favored. I have seen localities where the short-lived trees were dying out, and no others taking their places.

Such spots will hereafter take their places above the "timber line," which seems to me to be a line governed by circumstances more than altitude or quality of soil.

There are a few exceptions where pines will succeed pines in a burned down forest. *Pinus Murryana* grows up near the "timber line" in the Rocky Mountains. This tree has persistent cones, which adhere to the trees for many years. I have counted sixteen-year cones on one of these trees, and examined burned down forests of this species. Many of the cones had apparently been imbedded in the earth as the trees fell, the heat had opened the cones, the seedlings were growing up in myriads, but not a conifer of any other kind could be seen as far as the fire had reached.

In the Michigan Peninsula, Northern Wisconsin and Minnesota, *Pinus Banksiana*, a comparatively worthless tree, is replacing the valuable

red pine (*Pinus resinosa*), and in the Sierras, *Pinus Contorta* and *Pinus tuberculata* are replacing the more valuable species by the same process.

In these cases also the worthless trees are the shortest lived, so we see that nature is doing all she can to remedy the evil. Man only is reckless, and especially the American man.

The Mexican will cut large limbs off from his trees for fuel, but will spare the tree. Even the poor Indian, when at the starvation point, stripping the bark from the heavy-wooded pines (*Pinus ponderosa*) for the mucilaginous matter being formed into sap-wood, will never take a strip wider than one-third the circumference of the tree, so that its growth shall not be injured.

Frequently we see articles in print stating that oaks are springing up in destroyed forests where oaks had never grown before. The writers are no doubt sincere, but they are careless. The only pine forests where oaks are not intermixed, are either on lands so sandy that oaks can not be made to grow on them at all, or so far north that they are beyond its northern limits.

In the Green Mountains and the New England forests, in the pine forests of Pennsylvania, in the Adirondacks, in Wisconsin and Michigan, except in sand, I have found oaks mixed with the pines and spruces. In Northwestern Minnesota, and in Northern Dakota, the oaks are near their northern limit, but even there the burr oak drags on an existence among the pines and white spruces.

In the Black Hills, in Dakota, poor, forlorn, scrubby oaks are scattered through the hills among the heavy wooded pines. On the Sierra Nevadas the oak region crosses the pine region, and scattering oaks reach far up into the mountains. Yet oaks will not flourish between the one-hundredth meridian and the eastern base of the Sierras, owing to the aridity of the climate. Recently we found oaks scattered through among redwoods on both sides of the Coast Range mountains. Darwin has truly said: "The oaks are driving the pines to the sands."

Wherever the oak is established, and we have seen that it is established wherever it can endure the soil and climate, it will remain there and keep on advancing.

The oak produces comparatively few seeds; where it produces a hundred seeds, the ash and maple will yield a thousand, and many others a hundred thousand. The acorn has no provision made by nature like other tree seeds. Many kinds have wings to float them on the water and carry them in the air, the wings placed in such a manner as to be carried by a rotary motion, reaching a wonderful distance, even in a very light wind.

Nearly every tree seed, except the acorn, has a case to protect it

while growing, either opening and carrying the seeds off to a distance when ripe, or falling with them to protect them till they begin to germinate. Even the equally large seeds of other kinds are protected in some way.

The hickory nut has a hard shell, which is protected by a strong covering until ripe.

The black walnut has both a hard shell and a fleshy covering. The acorn is the only seed I can think of which is left by nature to take care of itself.

It matures without protection, falls heavily and helplessly to the ground to be eaten and trodden on by animals, yet the few which escape, and those which are trodden under are well able to compete in the race for life.

While the elm and maple seeds are drying upon the surface, the hickories and walnuts waiting to be cracked, the acorn is at work with its coat off. It drives its tap-root into the earth in spite of grass and brush and litter. No matter if it is shaded by the forest trees so that the sun can not penetrate it, will manage to make a short stem and a few leaves the first season enough to keep life in the root, which will continue to drill in deeper and deeper.

When age or accident removes the tree which has overshadowed it, then it will assert itself. Fires may run over the land destroying almost every thing else, the oak will be killed to the ground, but it will throw up a new shoot the next spring, and when the opportunity arrives it will make a vigorous growth in proportion to the strength of the root, and throw out strong side roots, and after that care no more for its tap-root, which has been its only support, than a frog cares for the tail of a tadpole, after it has got its own legs.

There is no mystery about the succession of forest growths. Nothing in nature is more plain and simple.

We can not but admire her wisdom, economy and justness, compensating in another direction for any disadvantages a species may have to labor under. Every kind of tree has an interesting history in itself.

Seeds with a hard shell, or with a pulpy or resinous covering retarding their germination, are often the means of saving them from becoming extinct.

The red cedar (*Juniperus Virginiana*), reaching from Florida to and beyond Cape Cod, among the hills of Tennessee, through the middle states and New England, scattered through the western States and Territories at long distances apart, creeping up the Platte river in Nebraska—found only three in the Black Hills in Dakota in an extended search for the different trees which grew there. Found only one in a long

ramble in the hills at Las Vegas, New Mexico. Yet this tree has crept across the continent, and is found here and there in a northwesterly direction, between the Platte and the Pacific coast. Only for the resinous coating protecting those seeds this tree would not be found to-day scattered over that immense region.

FORESTS AND RAINFALL.

BY CASSIUS M. CLAY, WHITE HALL, KY.

The larger part of the earth's surface is covered by oceans, seas, lakes and streams. From all these surfaces evaporation goes on forever—intensified by the sun's rays, artificial warmth, natural volcanoes and the earth's natural heat. This moisture or vapor spreading over the earth, by losing its caloric, is precipitated in dew, frost, snow and rain. We do not know, but we believe, that the yearly evaporation is about the same, and, precipitated, goes through surface drainage, springs, rivulets and rivers, into the same reservoirs of water. From all land surfaces also goes on a lesser evaporation from the waters already deposited there from all the named sources. This moisture of the air, winds and clouds is precipitated by the cold of mountain heights and cool currents of air from the northern regions and by forests and other vegetation.

As human subsistence and life depend upon water, this is the capital question of all philosophy and political action.

The factors of man's action are two in the solution of this problem : the culture of the earth, and preventing the destruction of the forests and their restoration—for the destruction of the forests of the whole earth, would, to a great extent, destroy all animal and vegetable life.

Every tree and every plant is an artesian well ; through the roots, stems and leaves, throwing the earth covered waters into the adjacent air, by which it is moistened and fitted for animal and plant life. The humus of forests also holds the rain water in reserve for continued evaporation and the formation of springs, rivulets and rivers. But all evaporation produces cold, for, by a chemical law, whenever a solid or fluid is expended in bulk, heat is absorbed or *cold* is exhibited. Thus, water in warm climes, by evaporation in earthen unglazed vessels, through the pores, is kept cool ; and ice and salt mixed produce the freezing of cream. What

is more logical than that forests, for the same reason, producing cold, precipitate rain from over-passing clouds? So this moisture is expanded over large cultivated surfaces, and makes land fertile. Let us take a wider range of thought: The evaporation from the Gulf of Mexico and equatorial oceans sending up their waters into clouds in the higher air, and there passing over the arid forest-bare surfaces of the Gulf States, Tennessee and Kentucky, would lose no heat, and of course, could not be precipitated till they reached the heights of the Allegheny Mountains or cold currents of air from the north pole. Consequently all the cultivated lowlands in summer receiving no rains, would become a desert. In the winter months, when the sun's rays are feeble, much of this moisture would be precipitated by the natural and cooling evaporation of the land surfaces, and come upon us when we least desired it. Now for experience added to logic: I am a cultivator of the soil as well as a scientist. Sixty-two years ago I was a boy of fifteen, with a gun, hunting over more than three thousand acres of land, running four miles away to the Clay's Ferry on the Kentucky river. This tract was covered with almost unbroken forests, with hundreds of ravines, in all of which, with few exceptions, perennial springs were bubbling up in which I could quench my thirst in the midst of summer—now not a dozen remain. And the woods were cool in the warmest days of the year. Now all are arid surfaces.

My father built a mill of great blocks of limestone, with large bins for the holding of meal, which ran all summer. But, when I entered upon my estate, I killed by belting all the forests upon the tributaries of the mill stream and sowed the land in blue grass. The consequence was the mill was entirely useless, and long years ago, the waters having failed, I pulled it down and worked the stones into fences. In this nice stream were fish all the year round, when I could make a string of them as long as nine inches in a few hours; now they are gone, the stream being dry every summer so that not even craw-fish remain. Then a drouth destroying crops planted even in March with safety was unknown; now a drouth, cutting short corn crops, is the rule. Then we had mild, steady winters, snow rarely over the shoes. While I write, snow lies twenty inches deep on the level! From the Kentucky river to Lexington, Ky., about twenty miles of once the best land in the world, the summers are so dry that the raising of Indian corn has almost been abandoned on account of the drouth, and hay-making has been substituted, catching and utilizing the early rains. So our fruits—apples and grapes, etc.—began to fail, and their culture is most successful about the lakes of the north, where evaporation supplies ample moisture. This is not all; the winds sweeping over treeless plains of vast distances, make our climate each year more intolerable in winter—longer in duration and colder in degree—so that we are now all

more and more compelled to house our live stock, which once did well on out-door grass and tree-shelter. Nor does this denudation of the forests confine itself to these evils; the heads of streams cleared of forests, without humus to arrest the force of heavy rains, pour the mountain torrents down the rivers and cause disastrous floods, filling up our navigable streams with sediment, impeding navigation, and drying them up in summer. All the streams of the Mississippi are thus affected by the denudation of the lands. In these dry summers I find it impossible to make hydrangeas bloom well in tubs, though watered ever so much, because the hot air, absorbing so much of the moisture sent up into the leaves, there is not sap enough to force the flowers. In visiting lately the Louisville fair, however, on the streets leading thereto owned by the fashionable people, all being watered freely beneath the trees upon their grounds, flowers reached their highest bloom, because of the moist air. So by the destruction of trees the insectivorous birds are deprived of food and resting places, and hawks and other enemies compel their extermination. As I passed up the Platte river, several hundred miles towards the Rocky Mountains, over the stunted willows and other brush woods, I saw continually hawks hovering on the watch for birds. The consequence is that the locusts or grasshoppers rather, unchecked by this natural force of equilibrium, eat up all living vegetation, and thus aid in the perpetuation and expansion of the desert. So in all lands denuded once of trees, birds of course perish, and these winged pests aggravate the sterility. When I was a boy the woodpeckers and other birds were so plentiful that my father set me with a gun to watch the cherry and apple trees, and I killed hundreds in a day. Then the borer and codling moth were unknown, and now the birds are few and the insects many, and fruit almost worthless. Heavy forests have been found deeply buried in our western prairies, killed no doubt by Indian fires: and the Rocky Mountain locusts continue the sterility by destroying all vegetation. A city of California, in our times, has been destroyed by the drift from the mountains when the miners cleared away the forests. And the Hudson river—the life-blood of our great commercial city—is following the same pattern.

Great Britain and Ireland, and other sea-surrounded lands, retain their humidity after being cleared of trees, because the moisture from the surrounding water gives sufficient nutriment to vegetation—as the lands on the northern lakes are fertile for the same reasons. The destruction of the trees of the north African coasts has not only depopulated that part of the continent, but the winds unchecked from the great deserts of the interior, have impoverished the south of Europe, aided by the axe. These causes have also caused floods from the mountains to fill with sediment the pent up waters of dikes and walled rivers, till their beds have

been continually raised, and breaking their barriers, subject the valley to floods with disastrous effects to vegetable and animal life. So the north hillsides of all lands are more fertile than the south exposures to the sun's rays; which dry the surface, and subject them to washing from the heavy rains. Even Rome has been partly buried by these causes; and the malarial swamps have greatly increased in extent and disease in the later centuries. So in Arizona, Indian pottery has been found eighty feet beneath the present level.

The most remarkable city of antiquity—Petra—the capital of the ancient Edomites, famed for its wealth and magnificent palaces cut in the rock hills, the passway of vast commerce, is now in ruins, occupied by savage Arabs and wild beasts. Its surroundings are sand plains—detrition goes on from her barren mountains, and finally, no doubt, it will be covered with one wide desert, and its very existence be lost to distant generations. So the Euphrates and its cities are filled with sediments, and has lost its fitness for navigation, which, no doubt, in earlier ages caused the building of them there. The Homeric Troy is found now under two successive cities. Such results could only come of disastrous floods, and the winds of sand-clouds from treeless deserts. Even our own State, by the cultivation of tobacco, which leaves the soil exposed to winter rains from the treeless declivity, the land in many sections has been to the solid rock; so that it take long centuries to restore the surface, soil, and vegetation and forests once more. These facts are better known in Europe, where every civilized government has a department of forestry for preserving the present woods and for planting new trees. And this has been done also by some of our western States, for not only trees, but cultivated crops have proven fruitful of rains, where before nothing could be grown, while in the barbarian world the deserts are continued or enlarged by the hot winds sweeping over sand-wastes, no doubt once fertile lands. In southern Europe lands sterile for want of moisture, by restored forests and by judicious culture have been made fertile; notably is this the case on the south sea-coast of France where the sand-deserts by tree planting have been restored to cultivation, and the support of a new population. But for the want of such intelligent work the once fertile countries of India, Servia and Asia Minor remain sterile. In China, in our times, millions of men have perished by drouth-famine, in consequence of the destruction of forests. And with sterility many once famous cities have been covered up, not by upheavings of earth-worms, but by sand-blasts and debris of mountain floods. But volumes would not suffice to present all the facts. The prophets, who were the philosophers and seers of old, feeling the stolidity of the people, and impatient of coming calamities, cried out in alternate curses and eloquent implorations.

So I say once more the State should—having the inalienable right—cause one-fourth of *all lands*, more or less, to be kept in forests, and they being lost, to be restored. The “eminent domain,” even the case of “fee simples,” rests in the State, and the good of the people is the highest duty of government. For forests are the life-blood of the earth, and in their destruction follows the death of nations.

FORESTS AND RAINFALL.

Sylvester Fowler, of Stowell, Kansas, in speaking of forests and rainfall, says : * “I assert positively, and am confident that all candid old settlers will agree with the assertion that the climate of eastern Kansas has changed.

“The first change that I would notice is in the distribution of the rainfall. Formerly enough rain would fall on a quarter section of land to water a county and the adjacent county remain dry; also enough would fall in one night to make a crop if divided, and a three months’ drouth would follow. Now for some reason, the precipitation is more evenly, distributed over territory and through time. Again, there has been an improvement in the average humidity; there is more dew. During the continued drouth of 1886 in Pottawatomie county there were very few nights without some dew, and as a result there was a fine crop of corn. A drouth of the same duration twenty-five years ago would have meant a total failure of crops. These changes are, as I believe, largely due to the increased acreage of trees.

“Nor is this all. No one will deny that forests break the forces of the wind, or that high winds assist evaporation. Out here on the plains, where trees are conspicuous by their absence, there is seldom any dew, for the reason that it is seldom calm; and often after a heavy rain the wind blows with such violence that in two hours time no traces of moisture remain on the surface of the ground. Then young plants and tender vegetation of all kinds suffer. If one inch of precipitation in one locality will keep the ground moist the same length of time that two inches will in another, it is easy to sum up results. I do not think this is an overestimate of the difference between a treeless region and one covered with groves. I assert confidently that no wind blowing over and through frequent forests ever changes to a hot wind. It is true that west-

* Kansas Farmer, July 12th, 1888.

ern Missouri and eastern Kansas have occasional hot winds; but those winds are heated on the bare plains to the southwest, from which direction they always blow. No east or southeast wind in Kansas is ever a hot wind. This fact alone, and which is above dispute, should encourage the growth of trees on the plains. Cover western Texas and the Pan Handle with frequent groves, and hot winds will have had their day."

Prof. N. S. Shaler, in a discussion on Rivers and Valleys, in Scribner's Magazine for August, 1888, says: "When man resorted to the soil as the source of his food, he began to clear away the forests and by tillage to destroy the spongy covering of the earth which they created. With the advance of civilization all the great valleys on the northern temperate zone have been to a considerable extent deprived of their forest covering. In this new state of the surface, the rain-water is no longer held back as it was of old, but flows quickly over the surface of the soil, and enters the water ways. The result is that all the old channels bear, in times of flood, a body of water far greater than that which was put into them before the forests were cleared away. They have been compelled to widen their channels by cutting away a strip of the alluvial land on either side. Thus, in the case of the Ohio river the bed occupied by the flood water has, since the beginning of the present century, been widened to the amount of about one-fifth of its total diameter."

TREE CULTURE ON OUR PRAIRIES.

BY ISAAC SMUCKER, NEWARK, OHIO.

This paper was prepared at the request of the Ohio State Forestry Association, and read before that Society:

The important preliminary work to be done to make Forestry a success is to enlighten, instruct, inform, educate the public mind—impress the people with the importance of it to them, personally—show them how it will promote their own pecuniary interests—demonstrate to them that it will infallibly add to their wealth, individually, as well as to the Nation's wealth, and that it will be promotive in various ways of comfort and health. All this and much more can be done, and ought to be done with as little delay as possible.

Forestry, if properly fostered by National and State legislation, will add immensely to the wealth of all sections of our great country. This will be eminently true as to all the older States as well as to some of those of more recent admission into the Union, which in their primeval state

were heavily timbered, but have since been largely despoiled of the most valuable portion of it. Of this there can be no reasonable doubt, provided that the legislation in question is sustained and enforced by the spontaneous and generally pervading sentiment of the people. And this suggests the necessity of an enlightened public sentiment in respect to Forestry, and no less the duty of those who are in a position to take a part in moulding public opinion.

And if Forestry can be made thus valuable in those old settled States, that were once thickly covered with a dense forest of trees of enormous growth, since largely destroyed, but where there is still a considerable remnant of them left, of how much greater value would it be to the present large and rapidly increasing prospective occupants of the many millions of wholly treeless acres that now constitute our great western plains?

Believing that the promulgation of correct views and much needed information on the subject would tend to the promotion of Forestry in the treeless sections of the United States, where more than anywhere else the dedication of a limited portion of the land to the cultivation of trees would advance the interests and augment the wealth of the settlers, where in fact the conversion of prairie into woodland would be of incalculable benefit, I propose to offer a few thoughts on "Tree Culture on Our Prairies," trusting that I may be able to add somewhat to the interest now felt in the subject, and incidentally bring about good results. I am not able to offer much information based on personal experience in "Tree Culture," having been more iconoclastic than otherwise, in that I have cut down more trees than I have planted, but my aim is to point out the way in which the cause of Forestry can be advanced and the welfare of the people be promoted.

High authority claims that Forestry ought to be promoted because of its favorable climatic effects—because it checks somewhat the waste of the water supply in dry seasons, by reason of diminished evaporation—because of its tendency to retard the flow of surface water into the usual channels during protracted rains, or unusual snow melting season, thereby protecting to some extent against sudden inundations as well as protracted drouths, and because of the admirable sanitary influence it exerts.

Belts of forest trees in prairie countries are of great value as storm breaks, serving as a protection to crops, orchards, nurseries, barns, and domestic animals, and very much mitigate the furious wintry blasts that often rage around the houses of the settlers on our western plains. How much, then, would the comfort of the occupants of our now timberless regions be promoted by planting on each farm a small grove of berry-bear-

ing, nut-bearing and fruit-bearing shrubs and trees, such as the blackberry, the raspberry, the huckleberry, the cranberry, the blackhaws, the wild cherry, the service berry, and many others—of nuts, the pecan, the chincapin, the hazlenut, the walnut, the hickorynut, the butternut, the chestnut and others—and of fruit bearing shrubs and trees everything adapted to the soil and climate. This would be good Forestry, good Husbandry too, although it has the appearance of a rather free intermingling of Horticulture and Pomology with Forestry.

If not deemed arrogant I would take the liberty to urge it upon all the settlers on the treeless lands of the United States to plant, cultivate, protect, and by all suitable means, promote the growth of the different varieties of useful trees by judiciously selecting such as would be likely to have a rapid and vigorous development, having in view always such as are best adapted to the various soils at their command, as well as to the climate; the live oak for ship-building—the walnut, the butternut, the wild-cherry, the curled and bird's-eye maple and others for furniture—the chestnut, the blue and white ash, many varieties of oak, locust, pine and others for fencing and building purposes—the hickory of various kinds, the apple, the beech, the maple, the cedar, all kinds of oaks and other hard wood trees for the manufacture of wagons, carriages, agricultural implements, planes, tools and every thing else for which hard wood is indispensable—and the bass, or linden, the cottonwood, the poplar, the cucumber, the buckeye, the sycamore, the chestnut, many varieties of pine, several varieties of the willow, and others of similar kinds when trees of soft wood, rapid growth and speedy maturity are desired.

The foregoing suggestions commend themselves especially to all riparian proprietors who would advance their own pecuniary interests and promote their personal comfort. They could not do so, to the same extent, in any other way at so small an expenditure of time and money, and with the bestowal of a similar limited amount of labor, as by planting along the banks of the running streams on their domains rows of willows, cottonwoods, lindens and similar valuable trees of rapid growth, adapted to most alluvial soils. Such belts of speedily maturing trees would be invaluable in protecting the banks of the streams, soon yield valuable timber for use, reach full development at small cost, and occupy but little cultivable land.

As an inducement to the owners of prairie farms to carry into effect the foregoing suggestion, I would favor the exemption of all lands from taxation on which timber was successfully cultivated.

A further suggestion would be the passage of a law giving liberal encouragement to the planting of suitable trees along the highways, not

only the kind that would be useful for shade but for the fruit they bear, and specially the sugar and maple for the useful products they yield.

On a large proportion of farms of a quarter or half section, the cultivation of a few acres of timber would not involve the disuse of much cultivable land for raising crops, or for ordinary farming purposes, as there are ravines, nooks, hilltops, sidehills, comparatively barren knobs, swampy marshy lands unsuitable for grain-growing, or waste lands of some sort not well adapted to the plow, nor profitable for pasturage, which could well be dedicated to forestry purposes. But if there were no waste land the few acres of prairie converted into woodland would be the most valuable part of the farm, although it might be inferior in quality of soil and for grain-growing purposes to the least fertile portion of it. The vigorous growth of a very few acres of timber land, in thrifty condition, which required but little, if any labor after having been well started, would certainly be of greater intrinsic value, and represent a greater annual profit in the enhancement in the value of the land and otherwise, or be more productive than a tract composed of an equal number of acres devoted to common husbandry, after deducting the cost of the labor involved in the cultivation of it. Ten acres of forest and fruit trees (perhaps a smaller number), after having had a vigorous growth of fifteen years, would probably furnish for fuel and other purposes all the wood and timber required by the owner of a farm of ordinary size, and in half that number of years yield most if not all the fruit required. Small fruits, when carefully cultivated, and the conditions for rapid growth exist, may be expected in three years, and the peach tree can be brought into bearing in four years, the cherry tree in five years, and the apple tree, the plum, the quince and the pear trees in six years or less. And that would surely count more to him in dollars and cents (especially if he was in a wholly timberless locality and somewhat remote from a railroad, where coal would necessarily be expensive), than the average annual profits yielded by the same quantity of land whether cultivated or in pasturage.

Another suggestion I offer in this connection is that all guarantees that are practicable should be afforded by legislation and in every other possible way, for the protection of growing timber, whether cultivated or of spontaneous growth, against the terrible prairie fires that oftentimes rage so fearfully over large tracts of country, and are so very destructive to property, and not unfrequently even to human life itself. Certainly measures can and ought to be adopted to prevent the recurrence of prairie fires, if possible. The pecuniary interests of the people whose homes are on the prairies, the interests of Forestry, and above all the interests of Humanity, demand this. "These conflagrations usually result from the carelessness or viciousness of hunters or sportsmen who use firearms in pur-

suing game, in the autumn time, when dry grass or weeds, or other combustible substances that readily ignite cover the surface of the ground. Prairie fires are largely destructive of nurseries, recently planted orchards, and of young trees generally, and render it difficult to make tree culture a success. Forestry encounters no greater obstacles than prairie fires—no more potent enemies than those who carelessly or viciously start them. In all cases where culpability attaches either because of carelessness or viciousness, there ought to be legal authority to inflict proper punishment. Certainly some efficacious means should be found to give assurance of immunity from the dire results of the acts of careless or reckless fowlers and others who cause such devastating results on our prairies as are often witnessed."

I take it for granted that not many of the foregoing views would be seriously controverted by the great body of the owners and occupants of farms on our western plains. They, undoubtedly, more than all others, realize the full value of woodland. They know, experimentally, the full extent and nature of the privations its absence imposes—they have an every-day realization of the importance of having a sufficient quantity of forest on their farms to meet the current daily demands. They freely admit the indispensable necessity of planting and cultivating trees in order to have woodland, and that wood and timber can not be had in sufficient quantities to serve their purposes unless they do so, (except at large cost); moreover, they are willing to acknowledge their obligation to themselves, to posterity and to the Commonwealth to thus promote forestry.

Why, then, (these facts being admitted) has forestry made such slow progress on our prairies?

Several reasons might be given. Among them is the lack of faith with some in its success, so long as they have no protection against prairie fires; another is the lack of capital; still another is the want of time to devote to it, even if the inclination were present. But I am well assured that the chief cause will be found in the lack of information bearing on the subject. If a prairie farmer wishes to convert a limited number of his acres into woodland, he of course inquires after the best methods of doing so. Can it be best accomplished and in the shortest time by starting a nursery and afterwards transplanting from it, buy the trees grown in other nurseries or by sowing or planting the seeds and nuts where the shrubs or trees are to remain? Shall he plant walnuts where he wishes a walnut grove, chestnuts, hickory nuts, butternuts, acorns beechnuts, where he wishes groves of those trees, or can it be done better otherwise? He should know the proper time in the year for sowing or planting seeds and nuts, and for transplanting, and what kinds of

trees and shrubs are best adapted to his soil and climate. He wishes to know just how he can grow a forest with the least labor and bring it into utilization in the shortest possible time, and with the smallest outlay of money. He also needs to be enlightened as to the best methods of sowing seeds, of planting nuts and of transplanting shrubs and trees, and of the cultivation, protection and management generally of growing timber. In view of the foregoing facts it seems to be quite clear that one of the prairie farmer's needs is a brief treatise on forestry, written in popular style, adapted to the capacity of common minds, one that can be understood by every man that can read the English language, a book, in short, that shall contain all the information suggested in this paragraph, and every thing else bearing on forestry that every agriculturist on our prairies ought to possess; and further, said disquisition ought to be compressed into as small a space as practicable, not to exceed 200, or at most 300 pages, (duodecimo) and furnished at a nominal price, so that it may find its way into as many homes as possible.

Is such a treatise accessible at present? I am not very familiar with the style and character of forestry literature, and know not how well the public needs are met in this regard; but if there is no such book in the market, or what would be better still, one of smaller dimensions than the one above suggested, it seems to me that the best service that can now be rendered to forestry would be to take immediate measures to get just such a little book into the hands of a hundred thousand of the "tillers of the soil on our almost boundless western plains." And that could probably be well done and speedily by the Ohio Forestry Association. Forestry associations, also agricultural and kindred societies, would be appropriate and efficient instrumentalities to assist in placing such a volume into a hundred thousand libraries, where it would be accessible to half a million of readers eager to possess themselves of the valuable information it contained. The little book should not be copyrighted, then the aid of the local weekly newspapers, also of agricultural newspapers, and other publications like the New York Weekly *Tribune* and of many others that have well conducted agricultural departments, and circulate extensively on the prairies, could be invoked to "lend a helping hand" in imparting the valuable practical instruction it contained by republishing the whole of it, in parts, or portions of it at their discretion. Forestry, by the liberal and persevering use of such means, would receive a great impetus and become more popularized than through the use of any or all of the present available instrumentalities.

FOREST PLANTING IN VIRGINIA.

BY BURNETT LANDRETH, PRES. OF THE ASSOCIATION.

[A paper read at the third annual meeting of the Penn. Forestry Association, in January, 1890.]

Forestry, as practiced in Scotland, France and Germany, treats principally of the oversight of artificial woodlands, and the further extension of such plantations. In America we have 400,000,000 acres of natural forests, and none of artificial; 400,000,000 seems a large area—but of this from 5,000,000 to 7,000,000 acres are annually burned over by forest fires, and the rest is being cut so rapidly and wastefully that it will all be gone before a new crop of trees of saw-log dimensions can be grown; but to develop a white pine tree to saw-log size takes eighty years, and to develop a long-leaved Southern pine to saw-log size takes one hundred years. Now, what is to be done? Why, curtail, under State and National legislation, the wholesale destruction of our national forests, till new forests are planted and developed.

Artificial forest development in Europe is the main feature. Natural forest preservation in America should be the main feature, planting being secondary.

Each man, however, who enters practically into forest work must take it up as determined by the conditions surrounding the district in which he proposes to operate. Now it happens that the personal work presented to me is not to preserve natural forests on mountain sides, but to endeavor to build up an artificial low-land forest.

In 1870, the senior of my firm, who had for a long life been a collector and planter of trees for ornamental purposes, till he had established a noted collection, conceived the plan of planting trees for forest purposes, on a large area of old farm land in eastern Virginia, where, on the lower Chesapeake, we held about 5,000 acres. The meteorological conditions of the locality, may be briefly described by stating that the annual rainfall is forty-nine inches. The relative humidity, both during summer and winter, 73. The maximum temperature is 103 degrees, the minimum 1 degree below zero. The wind in summer southwest, in winter from the north.

Of this tract about two-thirds was in natural and second growth pine, with some hard wood interspersed. He decided to plant the open farm fields, and follow upon the stump-land as the forest was cut off. Experience had made very clear to us the wonderful reproductive capacity of the soil of tide-water Virginia, in reclothing itself with the natural pine.

of that region—*Pinus taeda*—Loblolly pine, or old field pine, two varieties of which are known to the wood-cutter—the Rosemary and the Fox-tail. Still we thought it might be profitable to establish forests of varieties, both evergreen and deciduous, not common to that section, which would promise to be more profitable than the ordinary Virginia pine. The varieties of native deciduous trees found there comprise the chestnut, walnut ash, oak, and many others, but rarely occurring in forests of one variety, always mixed; nature grows them that way. So we concluded to try the experiment of forest planting, which, if it were not profitable to us or our successors, might, at least, serve as a guide to outline the future course of others in that portion of Virginia. Accordingly, in 1870, we began operations, and in 1871 planted a field of one hundred acres with the nuts of the black walnut, depositing the nuts at one foot apart in open furrows drawn at eight feet apart. We followed this by planting eight acres with the nuts of the chestnut.

The next year, 1872, we continued planting both tree seeds and seedlings. Of seedlings we purchased and set out the following:

Black locusts.....	30,000
Cypress.....	5,000
European larch.....	5,000

These were planted in solid blocks, 4x4 feet apart, intending that they should prune themselves.

In 1873 we planted tree seeds as follows:

Black locusts.....	4 bushels.
Chestnuts.....	12 bushels.
European larch	½ bushel.

In 1874 we continued the seed planting, putting in

Black walnuts.....	150 bushels.
Hickory nuts.....	10 bushels.
Chestnuts.....	22 bushels.
Larch	1 bushel.
Catalpa	10 bushels.
Poplar.....	3 bushels.
Pecan	3 bushels.
White oak acorns.....	1 bushel.
Italian sumac.....	½ bushel.

And of seedlings we set:

Eastern catalpa.....	2,000
Western catalpa.....	5,000
Black locusts.....	75,000

In 1887 we set out:

Catalpa.....	10,000
White ash.....	1,000
White pine.....	15,000
Douglas fir	1,000

In 1879 we set out :

Catalpa speciosa.....	40,000
Catalpa Japonica.....	1,000
Catalpa bignonioides.....	150,000
Ailanthus.....	10,000
Douglas fir.....	3,000

Since the last date, 1879, we have set a large number of catalpa, and this winter we will have about 100,000 seedlings to plant.

Now what has been the result? Much disappointment. But we do not despair of some success. I will relate our failures, and then the successes, if there be any.

We were first disappointed in the failure of the Black locust plantations. The early groves reached a height of twelve feet, the later ones, of course, being less—the larger tracts forming most impressive studies. The trunks stocky, straight and limbless, the upper branches all interlaced, forming a solid roof, the midday sun seldom reaching the alleys between the trees. They gave promise of a fine locust forest, just such as we had pictured, but hardly expected to realize. Alas! one September the locust tree borer mysteriously descended in swarms upon our typical locust groves, laying millions of eggs, which produced myriads of grubs, which by the next mid-summer had ruined every tree. We cut the trees and pulled out the roots with oxen, the expenses of the removal being \$25 per acre. We were done with the locust.

A description of the locust tree borer may be interesting. The mature insect is found in the locust tree in August and September, the eggs being deposited then in crevices of the bark, and hatching in ten days, when the grubs burrow into the soft skin or outer bark, where they remain in a torpid state during winter. In the spring they bore deeply penetrating the hard wood of the branches and trunk, the passage being one-quarter of an inch in diameter, and sometimes a foot in length and always upwards—presumably to guard against the entrance of rain. The larva then becomes a pupa, when in about two weeks it emerges as a perfect insect, three-quarters of an inch in length, and in a gorgeous livery of black and gold. Limbs and branches suffering from the attack of this borer become distorted by swollen growths of unhealthy wood—efforts of the tree to repair the injury. Nothing will serve, however; the injury is done, and the limbs gradually break away till the tree stands a dilapidated wreck.

Next the Swiss or Scotch larch gave out, piping of the trunks, the main stem breaking off at about twelve feet in height. It did not promise well at any time, this tree doing best upon dry rocky soil; ours was a sand with clay subsoil.

The next failure was with the Southern deciduous cypress. It disappointed us except in wet bottoms, so that we struck it off the list.

Of hickory and pecan, the nuts planted were, to a great extent, stolen by the squirrels, woodchucks, and field mice, and those which did vegetate made such slow growth that we plowed them out and replanted the ground with catalpa.

The tulip poplar was not a success, the rabbits and field mice during winter ate off from the tender seedling the sweet juicy bark and destroyed nearly every plant.

The white oak acorns were largely stolen by squirrels, woodchucks, rabbits and field mice, which ate the bark of the young seedlings, as they did of the poplar.

The Italian sumac, planted for its leaves, still stands, but the percentage of tannic acid in its foliage is not greater than in the leaves of the wild Virginia sumac. So its cultivation does not offer much hope for profit.

Thus we have failed with black locusts, and deciduous cypress, Scotch larch, hickory, pecan, tulip poplar, oak, maclura (osage orange), wild black cherry, ailanthus, ash, mulberry and some others.

Our successes have been principally in determining which varieties were not profitable to plant.* Certainly in this respect we prospered famously. Our other successes, such as they are, have been achieved with four trees —catalpa, black walnut white pine, Douglas fir, two deciduous trees and two evergreens, and the two deciduous might be reduced to one, the catalpa. Of this, the catalpa, we have abandoned several tracts, and after most serious ravages by stray crows, half-wild pigs, rabbits, squirrels, mice and fire, we have about 200,000 trees, ranging in height from two to twenty feet according to the period of planting. They stand in rows six feet apart, many of the rows a quarter of a mile long, and promise to make in time, fine forest studies, if not eaten up, for the catalpa has its insect enemies as well as other trees. Two years ago every tree was denuded of its leaves within a period of a month by the ravages of catalpa sphinx (*Daremma catalpae*). They have gone, but they may come again, and may stay with us. Still, this contingency of destruction by insects unavoidably attaches to the culture of any forest tree. To describe the catalpa, I will say that there are two types cultivated for forest purposes, the eastern and the western (indicated botanically as *bignonioides* and *speciosa*), the latter, the western being most approved. The tree is hardy as a chestnut, of quick growth, the trunk and limbs by reason of resistance to decay, being valuable for fence posts, gate posts and mud-sills. I have a piece of

*This remark, be it borne in mind, refers to that locality in Virginia, for we have records of good success with some of the trees which were failures in Mr. Landreth's experiment.—A. L.

gate post which stood in place one hundred (100) years, and it is in a perfect state of preservation. The timber when sawed, takes a fine polish and is handsomely marked in its cellular structure. The catalpa has been used in the west for railroad ties, and possibly it makes serviceable ones. By some forestry writers it has been extolled as superior to the white oak, but that is nonsense. Certainly these enthusiasts do not understand that a first-class tie must have other merits than resistance to decay engendered by moisture.

The catalpa is deficient in resistance to the hammering of the rail under passing trains, and it is deficient in that adhesive power upon railroad spikes possessed by the white oak or chestnut. In oak very careful tests have proven that as much as a pull of 4,000 pounds is required to draw out a spike driven five and one-half inches. In the catalpa the adhesive power is not one-half of 4,000 pounds.

The second variety of deciduous trees which we have planted in large numbers is the black walnut. In tidewater Virginia it is found wild and of noble proportions. Our seedlings, however, have grown very slowly. For the first six or seven years they grow but a little more than four inches a year, and it is only when they become very deeply rooted that they appear to start off vigorously. The lowland soils, however, are not adapted to the development of the best walnut timber, the wood produced there being too full of silex. It will not polish as smoothly as timber grown upon the soft prairie soil. It is stronger and better adapted for the legs and rounded portions of furniture, but as a rule does not furnish handsome paneling.

Our walnuts, of which we have 150,000 trees, after as many have been destroyed and others abandoned, do not impress us as of much value, and for the present we will not plant any more.

Turning to the evergreen family we have of white pine 14,000, a fine block of trees twelve to fifteen feet high, and now growing at the rate of two and three feet a year, quite as rapidly as native loblolly pine. Our attention was directed to the white pine as flourishing upon our particular soil by a wild settlement of this tree in the midst of our yellow pine forest. Here we found a parent tree, ninety feet high, grown probably from a seed dropped by a bird of passage, possibly from far off Maine. It has germinated, reached maturity, and developed seed, which falling around, had in turn germinated and developed seed-bearing trees, till now the growth of many generations of trees stand in concentric circles—this natural group clearly indicating the adaptability of the soil and climate. This example and the results of our own plantations, make it quite evident that the white pine can be grown very successfully, the principal

difficulty being in securing a stand in the first instance, as a large percentage of the seedlings die.

As the catalpa is the best of deciduous trees, I think the Douglas fir is the best of the two evergreens; it is equally as rapid in growth as the white pine, and, if it reaches maturity and escapes the ills of forest life, it will be more valuable, one of its merits being in its early maturity; its long, tapering and light wood trunk particularly suiting it for ship spars, while on the other hand older trees reach vast proportions, and form a trunk far surpassing the white pine of Maine. The Douglas fir for eastern plantations should be grown from Colorado seed, as the Oregon type is not so hardy. I would recommend that the white pine and the Douglass fir be planted in alternate rows, so that in case of destruction of either variety by insect depredations or soil influences, there may be the chance of the remaining variety reaching maturity. Indeed, all plantations should be mixed for the same reason, but they must be mixed judiciously.

After eighteen years of practical forest planting on a small scale, I conclude that for the particular region of tidewater Virgina, and I think I may venture to say as well for tidewater Delaware, Maryland and North Carolina, there are only *four* trees to plant; and I conclude, also, that it is very questionable if it be profitable in that region to plant at all so long as the wild pine will spring up in every field just as soon as annual cultivation ceases. How the seeds get there I do not know, for they will spring up in the centre of a one hundred acre field simultaneously with their appearance upon its tree fringed borders. This pine will start without plowing, and it will grow under the most adverse circumstances. It will take care of itself in spite of wild hogs and stray cattle. Fire is its enemy. In twenty years it will make twenty cords of brick-yard wood to the acre, and for every year thereafter an additional cord or more, till at forty years it will cut fifty cords of first-class wood, the only expense being the taxes, which, State and county together, do not equal one-half of 1 per cent.

WAGON TIMBER

GROWN FROM SEEDS ON THE PRAIRIES OF ILLINOIS.

In that admirable paper "Forest Cultivation for Profit," by Mr. Martin Conrad, published in the last annual report of this Bureau, reference is made* to the plantation of Mr. A. R. Whitney, of Franklin Grove, Ill.

*Third Annual Report Ohio State Forestry Bureau, p. 48

who has, it is said, probably a greater number of different species of forest trees growing on his farm, raised from seed planted by himself, and now of size sufficient for sawing into lumber, than any person in America.

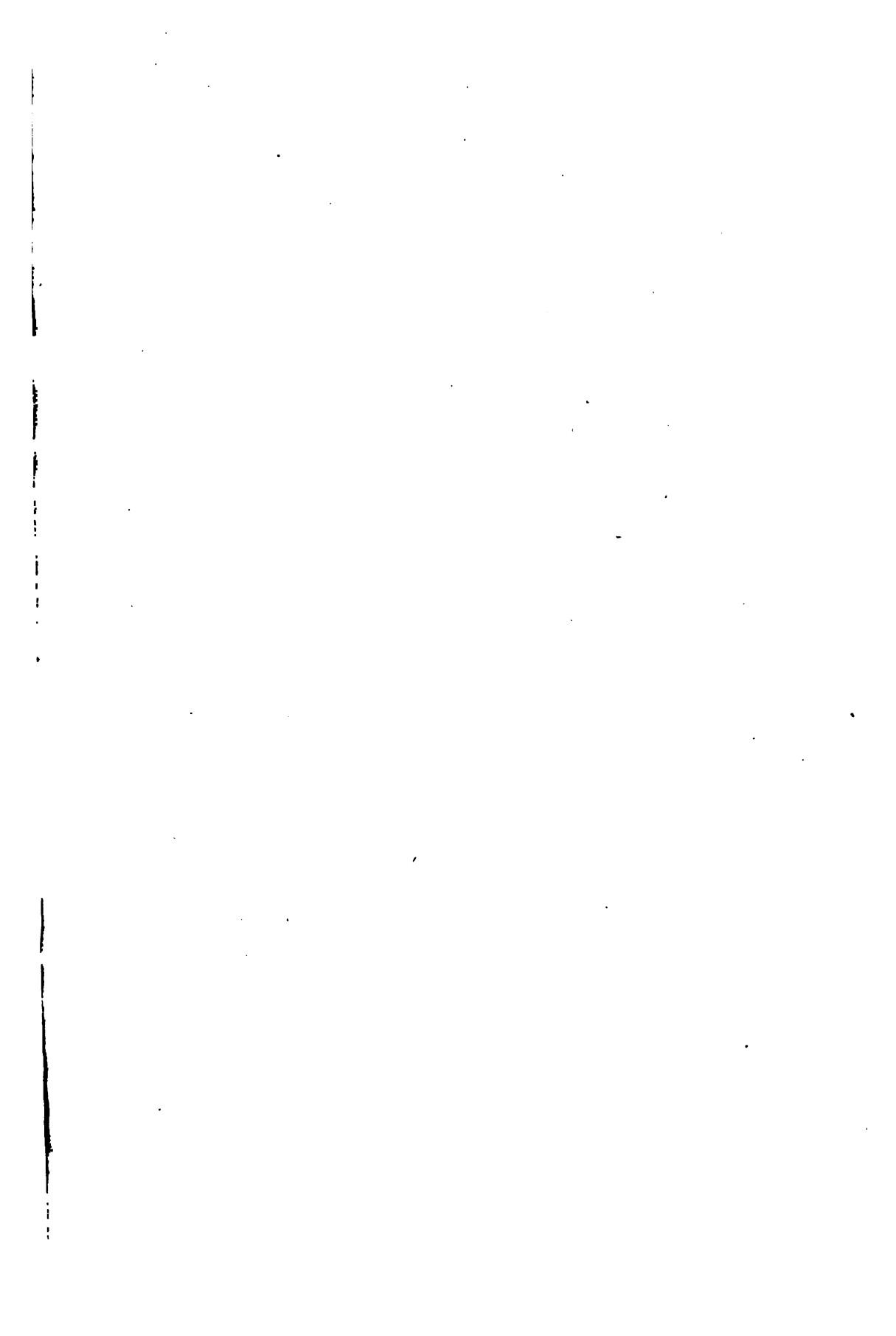
Mr. Conrad, an eminently practical man of the firm of Schutler and Hoty, of Chicago, Ill., desirous of showing in a practical way what a well directed effort in Forestry might accomplish, selected from Mr. Whitney's plantation the following kinds of trees, which he used in making a wagon.

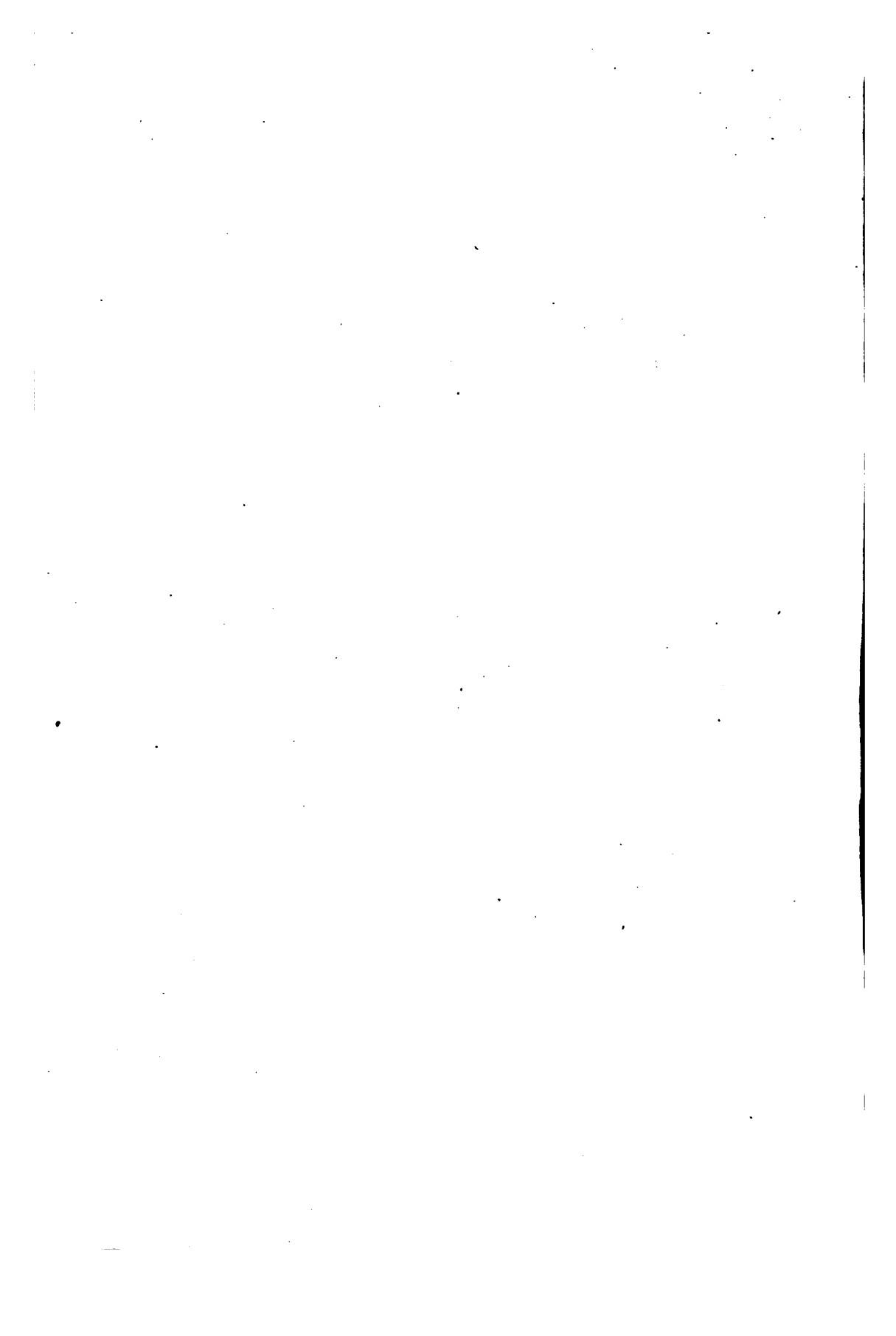
1. *Oak*—Used in all the spokes.
2. *White Ash*—In the front hounds, sway bar, neck-yoke and single-trees.
3. *Hard Maple*—Front and hind axles, double-tree and break-bar.
4. *Red Flowering Maple*—In the center-piece of foot-board, the bottom cross-pieces and break push-bar.
5. *White-wood*—In the sides, ends and top-box.
6. *Honey-Locust*—In the felloes, the pole-hounds, the sand-board, hind-hounds and bottom of seat.
7. *Black Locust*—Posts for breaks.
8. *Chestnut*—In the tongue, the reach, and ends and back of the seat.
9. *Black Walnut*—In the sides, ends, bottom, foot-board and top-box.
10. *Butternut*—Cleats on side-boards, to receive the end-gates and cleats on end-gates.
11. *Beech*—Cleats on sideboards, each side of bolster-stakes.
12. *Ironwood*—One front and one hind hub.
13. *American Larch*—Cleats under bottom against the bolster.
14. *European Larch*—Box bottom.
15. *Soft Maple*—Top-box stakes, and strip on front bolster.
16. *Apple*—One front and one hind hub.
17. *Willow*—Upper spring blocks on the seat.
18. *Oxage Orange*—Bolster stakes, and pole cross-piece.
19. *Red Mulberry*—Front and hind bolsters, break-blocks, roller block] and lower spring-blocks of the seat.
20. *Red Cedar*—Slider cleats for brake, under bottom.

The wood is preserved in its natural color polished and varnished. This unique wagon was to be on exhibition in the Forestry Department of the Exposition and would certainly have been a great attraction. The Exposition Commissioners, however, looking upon this as upon a common wagon, objected to its being entered as an educational means. While negotiations with Mr. Conrad were in progress, the Commissioners of the Kansas City Exposition offered to admit the wagon without charge for entry or space. This famous vehicle is now on its way to the Paris Exposition.

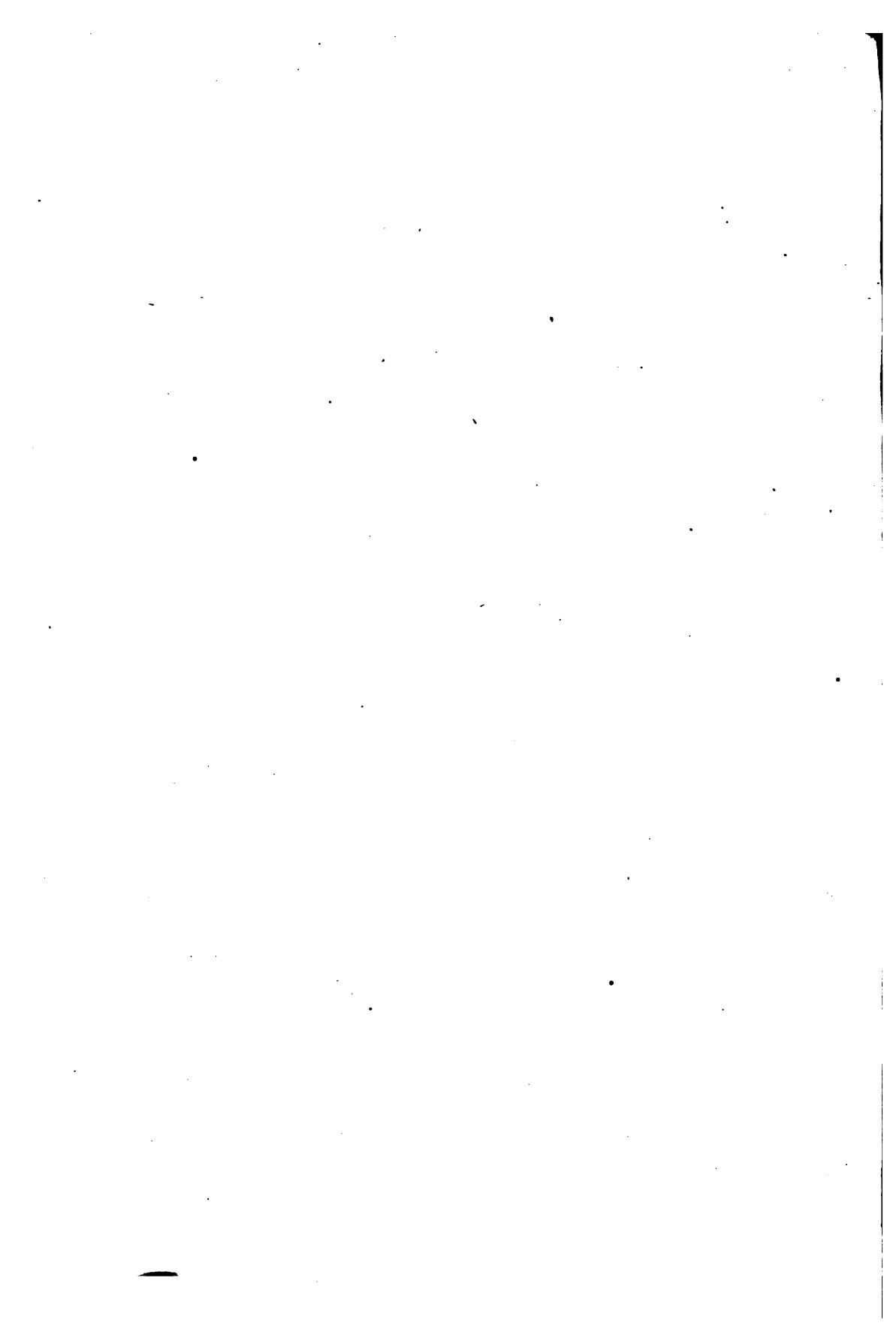
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